VOL. 82, NO. 1 MARCH, 1953

THE PHILIPPINE JOURNAL OF SCIENCE

MANILA
BUREAU OF PRINTING
1953

31320

COMMONWEALTH MYCOLOGICAL INSTITUTE
29 MAR 1954

THE PHILIPPINE JOURNAL OF SCIENCE

Published by the Institute of Science and Technology
(Formerly Bureau of Science)

JOAQUIN MARAÑON, D.Sc., *Editor*
EDUARDO QUISUMBING, Ph.D., *Associate Editor*

CONTRIBUTING EDITORS

Chemistry

MANUEL L. ROXAS, Ph.D.; F. T. ADRIANO, Ph.D.; R. H. AGUILAR, Ch.E.
PATROCINIO VALENZUELA, Ph.D.; MARCOS M. ALICANTE, Ph.D.
A. J. HERMANO, D.Sc.; FELIX V. ESPINO, Ch.E.

Geology

V. ELICAÑO, B.S.; ANTONIO D. ALVIR, Ph.D.; JOSE FELICIANO, Ph.D.

Experimental Medicines

DANIEL DE LA PAZ, M.D.; ARTURO GARCIA, M.D.; ONOFRE GARCIA, M.D.
CRISTOBAL MANALANG, M.D.; H. W. WADE, M.D.
WALFRIDO DE LEON, M.D.

Clinical Medicine

ANTONIO SISON, M.D.; AGERICO B. M. SISON, M.D.
LIBORO GOMEZ, M.D., Ph.D.; H. LARA, M.D.
JOSE RODRIGUEZ, M.D.; CARMELO REYES, M.D.

Botany

ELMER D. MERRILL, D.Sc.; E. B. COPELAND, Ph.D.; A. F. FISCHER, C.E. M.F.
T. G. FAJARDO, Ph.D.; NICANOR G. TEODORO, Ph.D.
FELICIANO M. CLARA, Ph.D.; NEMESIO P. MENDIOLA, Ph.D.

Zoology

LEOPOLDO B. UICHANCO, D.Sc.; DEOGRACIAS V. VILLADOLID, Ph.D.
HERACLIO R. MONTALBAN, M.A.; GONZALO MERINO, Ph.D.
CANUTO B. MANUEL, D.Sc.; MANUEL D. SUMULONG, M.S., D.V.M.
LOPE M. YUTUC, D.V.M.; FAUSTINO Q. OTANES, M.S.
LEOPOLDO S. CLEMENTE, Ph.D.

Anthropology

H. O. BEYER, M.A.; RICARDO E. GALANG, M.A.

THE PHILIPPINE JOURNAL OF SCIENCE

VOL. 82 MARCH, 1953 No. 1

PRELIMINARY STUDIES ON THE UTILIZATION OF COPRA MEAL FOR PLASTICS

By MAGDALENA ALDE TEMPLA

Of the Institute of Science and Technology, Manila

ONE TEXT FIGURE

The Philippines has a production of approximately 2,303,077,909(25) coconuts (nuts) every year. From about 504,391,986(25) kilos or 504,392 tons of copra made, 389,-985,296(25) kilos of copra and 5,858,540(25) kilos of copra meal are exported. These leave 45,625,470 kilos or about 45,625 tons of copra meal. Aside from a very small percentage of copra meal used for animal feed and fertilizer all the rest go to waste.

Among studies that had been made on the preparation of plastics from agricultural residues, Brother and McKinney(9), in 1940, prepared protein plastics from soybean products. In 1941 Aronovsky and Clark(2) used bagasse and other residues. McKinney, et al.(20), in 1943, prepared soybean-modified phenolic plastics in which wood flour, soybean meal with phenol-formaldehyde mixtures were used. Clark, Williamson, and Lathrop(12), in 1945, prepared plastics from corncobs, corn-stover, wheat straw, flax shives, hemp hurds and peanut shells with commercial phenol-formaldehyde resins. No mention has so far been made regarding the use of copra meal as a material for plastics.

The aim of this paper is to make use of the copra meal, along with phenol-formaldehyde resins and Manila copal, in the preparation of plastics.

31320

Copra meal contains about 20 per cent protein. This would make it a possible raw material with binding properties in it for this purpose. In this investigation, copra meal was mixed with resin and wood flour to produce a plastic molding powder. Several methods of preparation were used to find out its possibilities as a plastic material. The use of lubricants and accelerators was eliminated purposely to observe the characteristic properties of the molded plastic material. Different molding pressures were applied. The technique and preparations used were adapted to the available equipment and facilities in the laboratory.

RAW MATERIALS

The copra meal used in this investigation was obtained from the Philippine Manufacturing Company. Upon analysis, it was found to contain the following:

TABLE 1. *Analysis of copra meal.*

	Per cent
Moisture	6.73
Protein	20.18
Oil	9.78
Carbohydrates (by difference include crude fiber and ash)	63.31

In the preparation of the copra meal plastic molding powder, commercial Manila copal and phenol-formaldehyde resin were used for comparative purposes. The aim was to produce a product exclusively from local raw materials. Phenol-formaldehyde resin, however, was used, having in mind the facts that phenol could be obtained from the destructive distillation of cornstalk alkali-lignin(7), corn being the fourth leading crop of the Philippines. Wood flour prepared from sawdust, a waste product from sawmills, was also used.

METHODS OF PREPARATION

Four methods were used in this investigation.

Method I.—Method I consisted of a mechanical mixing of commercial Manila copal, copra meal and wood flour in the proportion of 40 per cent Manila copal, 40 per cent copra meal and 20 per cent wood flour. Mixing was carried out in a ball mill for 16 hours. The molding powder produced was molded in a laboratory Carver press at different pressures and a temperature of 175°F for two minutes.

Method II.—The mixture was exactly the same as that of Method I. This was heated at 115°C in an oven for three hours before introducing it into the ball mill. Mixing operation was 16 hours. The molding powder was molded in a laboratory Carver press at different pressures and at a temperature of 175°F for two minutes.

Method III.—A dry mix method was used. Phenol-formaldehyde resin was prepared in the mold ratio of 1:1.5. Ammonium hydroxide was used to catalyze the reaction. This resin was used in the mixture in the proportion of 40 parts phenol-formaldehyde resin, 40 parts copra meal and 20 parts wood flour. The resulting mixture was placed in the ball mill for 24 hours mixing. The prepared molding powder was molded at different pressures at a temperature of 300°F for three minutes.

Method IV.—This was a wet mix method of preparation. The phenol, formaldehyde, ammonium hydroxide and copra meal were mixed together and heated for three hours at 120°C. Then the wood flour was incorporated and the whole mixture dried in the oven at 115°C for six hours. This was mixed in the ball mill for 24 hours. The formula consisted of:

400 grams copra meal
762 grams phenol
980 grams 37 per cent formaldehyde
10 grams of concentrated ammonium hydroxide
400 grams wood flour

The prepared molding powder was molded at different pressures at a temperature of 300°F for three minutes.

In the procedures that were followed the resulting molding powders were not worked in calendar rolls. This was due to lack of this equipment in the laboratory. The lowering of moisture content with this step would have greatly affected the results in water absorption of the final product.

TESTS

The following tests were carried: specific gravity, clarity, flexural strength, water absorption, appearance after drying, and color, molding and machining qualities. The procedures of the A.S.T.M.(1) in these tests were modified to suit the size of the samples obtained.

Flexural strength.—The results of the tests are given in Tables 2 and 3. The flexural strength of the samples obtained from Method I was the highest of all. The figures ranged from 3,250 psi to 6,640 psi, respectively.

Figure I shows the graphic representation of the relation of flexural strength and molding pressures of the samples obtained by the different methods. It could be deduced from the graphs that the flexural strength is a direct function of the molding pressure.

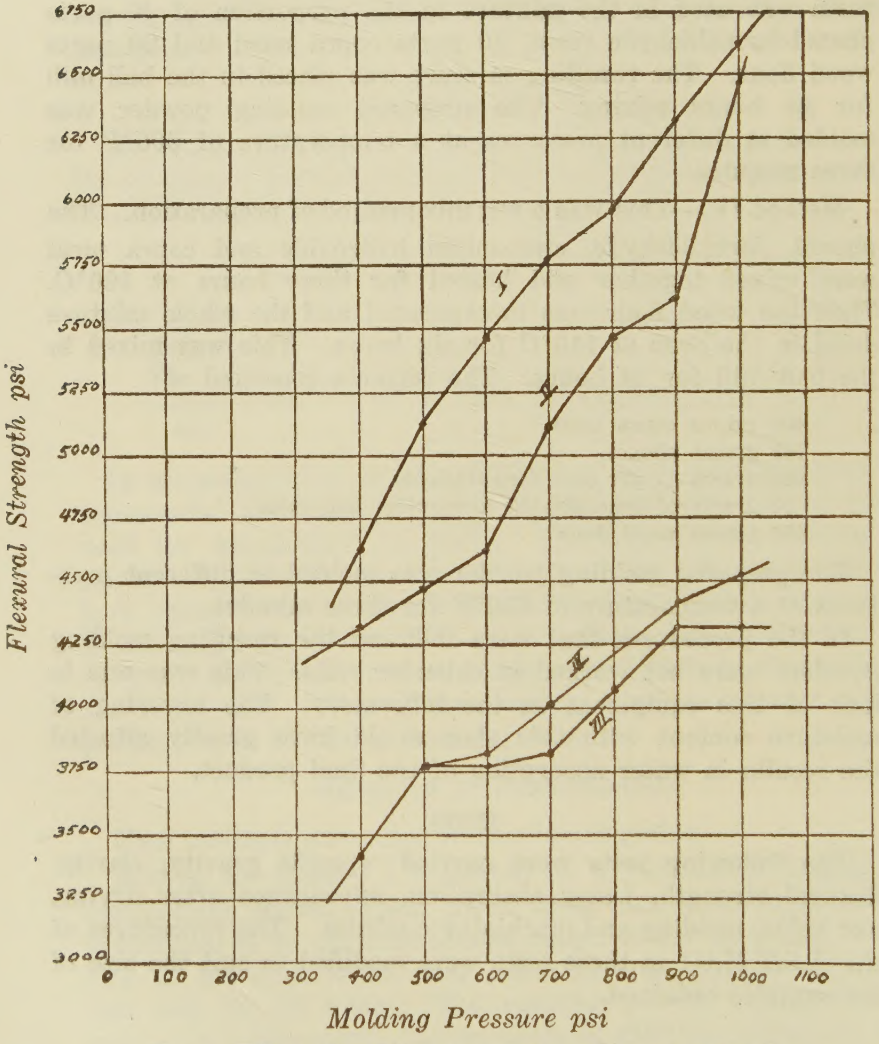


FIG. 1. Effect of molding pressure on flexural strength.

Resistance to moisture.—The samples for these tests were conditioned by placing them in a dessicator for 24 hours at room temperature, about 30°C. Their weights were taken after conditioning. The weighed samples were immersed in distilled water at room temperature for two hours and 24 hours respectively. Their weights after drying superficially were determined. The gain in weight was the amount of water absorbed. The appearance after drying was also noted and recorded. Tables 2 and 3 indicate the per cent of water absorbed. Samples prepared by Methods II and IV gave lower per cent of water absorption. After 24 hours of immersion in water, the per cent absorption ranged from 11.10 to 20.96. Preheating of mixture as in Method II reduced the absorption of water in the samples.

Percentage of water absorption which may be due to the protein and other water soluble matters present in copra meal, can be reduced by leaching copra meal. This treatment will remove water soluble material. This is followed by heat denaturation.(20)

Specific gravity.—The specific gravity as found ranged from 1.30 to 1.35.

Color.—It was observed that the color of molded samples where no preheating was made was very much lighter than the preheated ones. Different colors of dark shades could be produced by adding the necessary dyes to the mixtures.

Molding qualities.—The molded samples had good molding qualities.

Machining qualities.—The molded samples were machined and found to have good machining qualities.

Clarity.—The molding powders after molding produced opaque samples.

Other tests.—A sample of molding powder prepared in Method III which was molded and tested * for its properties gave the following results:

Compression molding pressure psi.	1,000
Compression molding temperature °F	300
Specific gravity	1.35
Water absorption, 24 hours (per cent)	18.36
Hardness, Rockwell	L–1.04
Flexural strength psi.	4,837
Impact strength ft. lbs./in. of notch	1.1
Dielectric constant 10 KC	11.1
Dielectric constant 100 KC	8.53

* The sample was prepared and tested in the Organic Plastic Section under Dr. G. Kline and Dr. A. Scott, of the Electrical Section of the National Bureau of Standards, Washington, D. C., U. S. A.

Thermal conductivity, 10^{-4} cal. per sec.	8.8×10^{-13}
Volume resistivity, ohm-cm (40 per cent relative humidity, 23°C)	1.1×10^{12}
Clarity	Opaque
Machining qualities	Good
Molding qualities	Good
Color possibilities	Dark colors

TABLE 2.—*Copra meal copal plastic.*

Sample Number	Molding pressure psi.	Flexural strength psi.	Water absorbed *Per cent* 2 hrs.	Water absorbed *Per cent* 24 hrs.	Appearance after drying
Method I [a]:					
1	400	4608	7.43	16.55	Smooth
2	500	5120	7.80	16.75	Smooth cracked on edge
3	600	5460	8.04	18.14	Smooth cracked on edge
4	700	5800	8.21	18.27	Smooth, slightly cracked on edge
5	800	5972	7.71	18.30	Smooth cracked on edge
6	900	6316	8.10	18.46	Smooth cracked on edge
7	1000	6640	9.53	18.36	Smooth cracked on edge
Method II [a]:					
1	400	4268	3.11	12.32	Smooth
2	500	4436	2.76	12.02	Smooth, slightly cracked on edge
3	600	4608	3.82	12.25	Smooth
4	700	5120	3.05	11.80	Smooth
5	800	5460	2.64	11.47	Smooth, slightly cracked on edge
6	900	5632	2.95	11.42	Smooth, slightly cracked on edge
7	1000	6484	2.96	11.10	Smooth, slightly cracked on edge

[a] Molded at a temperature of 175°F for two minutes.

TABLE 3.—*Copra meal phenolic plastics.*

Sample Number	Moulding pressure psi.	Flexural strength psi.	Water absorbed *Per cent* 2 hrs.	Water absorbed *Per cent* 24 hrs.	Appearance after drying
Method III [b]:					
1	400	3412	9.85	20.96	Smooth, slightly cracked on edge
2	500	3756	7.40	16.04	Smooth, slightly cracked on edge
3	600	3756	8.49	17.97	Smooth, slightly cracked on edge
4	700	3824	6.59	16.69	Smooth, slightly cracked on edge
5	800	4096	5.66	12.56	Smooth, slightly cracked on edge
6	900	4264	6.08	13.04	Smooth, slightly cracked on edge
7	1000	4264	6.42	13.98	Smooth, slightly cracked on edge
Method IV [b]:					
1	400	3412	2.62	13.90	Smooth, slightly cracked on edge
2	500	3756	1.51	23.28	Smooth, slightly cracked on edge
3	600	3824	2.99	13.64	Smooth, slightly cracked on edge
4	700	4012	3.41	13.88	Smooth, slightly cracked on edge
5	800	4096	2.74	13.30	Smooth, slightly cracked on edge
6	900	4436	1.87	11.53	Smooth, slightly cracked on edge
7	1000	4524	2.71	13.54	Smooth, slightly cracked on edge

[b] Samples of Methods III and IV molded at a temperature of 300°F for three minutes.

SUMMARY

Copra meal plastic molding powders prepared from local and foreign materials are given.

Different methods of preparing the plastic powder are also reported. Some physical tests of the different mixtures are included.

The specific gravity ranged from 1.30 to 1.35.

The flexural strength was found to be a direct function of the molding pressure.

The molded products were opaque and dark in color.

Preheating the mixtures reduced the water absorption of the molded products.

The molding and machining qualities were found to be good.

The molding powders produced in this study could be molded into different articles where water absorption and exceedingly high flexural strength are of minor consideration.

ACKNOWLEDGMENT

The author wishes to express her appreciation and thanks to the Department of Commerce, U. S. A., that made it possible for her to work in the National Bureau of Standards, Washington, D. C., to Dr. Gordon Kline and his Staff in the Organic Plastics Section, and to Dr. A. Scott of the Electrical Section of this Bureau, and to Dr. Joaquin Maranon and Mr. Gil O. Opiana of the Institute of Science and Technology for their advice and criticism.

REFERENCES

1. American Society for Testing Materials. Standards Part III (1944) 2202.
2. Aronovsky, S. I., and T. F. Clark. Plastics from bagasse and other agricultural residues. Manufacturing Record 110 (1941) 22–25, 59.
3. Babcock, G. E., and A. K. Smith. Extending phenolic resin plywood glues with proteinaceous materials. Ind. Eng. Chem. 39 (1947) 85–88.
4. Beckel, A. C., W. C. Bull, and T. H. Hopper. Heat denaturation of protein in soybean meal. Ind. Eng. Chem. 34 (1942) 973–976.
5. Belter, P. A., A. C. Beckel, and A. K. Smith. Soybean protein production. Ind. Eng. Chem. 36 (1944) 799–803.
6. Boyer, R. A. Soybean protein fibers—experimental production. Ind. Eng. Chem. 32 (1940) 1549–1551.
7. Bridger, G. L. Phenols from cornstalk alkali lignin. Ind. Eng. Chem. 30 (1938) 1174.
8. Brother, G. H., and L. L. McKinney. Protein plastics from soybean products. Ind. Eng. Chem. 32 (1940) 1002–1006.

9. BROTHER, G. H., and L. L. MCKINNEY. Protein plastics from soybean products. Ind. Eng. Chem. 32 (1940) 1648–1651.

10. BURNETT, R. S. Peanut protein hydrates—preparation and properties. Ind. Eng. Chem. 37 (1945) 861–864.

11. BURNETT, R. S., and T. D'FONTAINE. Commercial peanut meal. Ind. Eng. Chem. 36 (1944) 284–288.

12. CLARK, T. F., R. V. WILLIAMSON, and E. C. LATHROP. Agricultural residues in plastics, Part I. Modern Plastics 23 (1945) 158–160, 214.

13. D'ALELIO, G. F. Experimental plastics and synthetic resins. New York, John Wiley and Sons, Inc., 1946. 185 pp.

14. DE LOLLIS, M. J. Industrial Adhesives, II. Prod. Eng. 12 (1947) 137–142.

15. KELLAWAY, F. W., and N. P. MEADWAY. Introducing plastics. Sussex, England, John Crowther Limited, 1945. 80 pp.

16. KILLEFER, D. H. Furfural steps into industry. Ind. Eng. Chem. 18 (1947) 1217.

17. KLINE, HARRY. Furfural in phenol resin laminates. Modern plastics 4 (1947) 101–103.

18. KLATZ, I. M., H. TRIWUSH, and M. F. WALKER. The binding of organic ions by proteins, composition phenomena and denaturation effects. Jour. Amer. Chem. Soc. 70 (1948) 2935–2941.

19. MCKINNEY, L. L. Utilization of soybean on molded plastics. U. S. Dept. of Agric. Bull. A1C–150 (1947) 3.

20. MCKINLEY, L. L., R. DEANIN, GLEN BABCOCK, and A. K. SMITH. Soybean-modified phenolic plastics. Ind. Eng. Chem. 35 (1943) 905–908.

21. NORELLI, PATRICK. Thermal effects on flexural strength of laminates. Modern plastics 3 (1948) 121–128, 188.

22. SMITH, A. K. Proteins as industrial raw materials. Chem. Ind. 58 (1946) 974–977.

23. SMITH, A. K., S. J. CIRCLE, and G. H. BROTHER. Peptization of soybean protein. The effect of neutral salts on the quantity of nitrogenous constituents extracted from oil-free meal. Jour. Amer. Chem. Soc. 60 (1938) 1316–1320.

24. WHITTEMORE, J. W. Industrial use of plasticizers, binders and other auxiliary agents. Amer. Ceram. Soc. Bull. 2 (1944) 427–432.

25. Yearbook of Philippine statistics. Manila, Bureau of the Census and statistics 1946 (1947) 155, 348–349.

EIGHT ADDITIONS TO THE PHILIPPINE FISH FAUNA, INCLUDING THREE NEW SPECIES

By Albert W. C. T. Herre
Of the School of Fisheries, University of Washington

The seas about the Philippines seem to be a general rendezvous for fishes from all parts of the tropical Indo-Pacific. Every Philippine collection examined by the author during the past thirty years has contained one or more surprising additions of fishes only known previously from some other region, often from some place thousands of kilometers away. At the same time species new to science are constantly being discovered.

The author urges intensive collecting of fishes from all parts of the Philippines. The best place to start is right in Manila Bay where the trawl catches should be studied with great care, especially in the parts near and beyond Corregidor. The same scrutiny should be extended to the fishes taken by trawlers in every area they work, as they are hauled up on board. We need to know the entire catch, and not just those fishes selected for market. From Y'Ami to Balabac and the Sarangani Islands there are great stretches of coast where no scientific collecting has ever been done.

Lengths given are the standard length; specimens are in the collection of the School of Fisheries, University of Washington.

KAUPICHTHYS DIODONTUS Schultz.

Kaupichthys diodontus Schultz, Fishes of the Phœnix and Samoan Islands. U. S. Nat. Mus. Bull. 180 (1943) 50, *plate 6.*

A specimen of this rare little eel, 98 mm long, was obtained from the reef at Dumaguete. The depth is 19.6, the head 6.125, the trunk 7 times in the length. The tail is 2.26 times the length of the head and trunk together.

This is the third specimen known and the first Philippine record.

MURAENICHTHYS ACUTIROSTRIS Weber and De Beaufort.

Muraenichthys acutirostris Weber and De Beaufort, Fishes Indo-Austr. Arch. 3 (1916) 279, *fig. 127.*

A specimen 104 mm long was taken on the reef at Dumaguete. This rare eel has been known heretofore from two specimens, 92 mm long, taken at Amboina.

CÆCULA MISOLENSIS (Günther).

Ophichthys misolensis GÜNTHER, Ann. Mag. Nat. Hist. 10 (1872) 425.
Dalophis misolensis JORDAN and SEALE, U. S. Bureau of Fisheries Bull. 25 (1906) 194.
Sphagebranchus misolensis WEBER and DE BEAUFORT, Fishes Indo-Austr. Arch. 3 (1916) 324.

The type and only specimen previously known was taken at Misol Island, and is 283 mm long. At Dumaguete I collected one 380 mm long. Probably owing to its much greater size it presents a number of differences from the type. The depth is 50, the head 15.8 times in the length; the head is 7 times in the trunk, instead of 6.6, as in the type. The head and trunk measure 193 mm, the tail 187, while in the type they are of equal length. The lower half is tan, the back more or less purplish brown, while the type is described as having uniform coloration.

PISOODONOPHIS COPELANDI Herre, new species.

The elongate body is nearly cylindrical, its breadth equal to or 0.8 of its depth, which is 36.6 to 37.8 times in the length. The dorsal and anal are very low, ending a short distance from the blunt tip of the tail; the dorsal origin is well behind the pectoral tip, and two-thirds the head length from the gill opening. The head is 12.6 to 14 times in the length, or 3.7 to 4 times in the trunk. The tail is 1.55 to 1.59 times in the length, or 62.37 to 64.25 per cent; the head and trunk are 1.68 to 1.8 times in the tail. The rounded pectorals are 4.4 to 4.8 times in the head.

The small head has weak jaws; the rounded snout is 2.25 to 2.33 times the eye; it is 13 to 16 times in the head; the posterior nostrils are below the front margin of the eye; the anterior nostrils are in downward pointing tubules on each side of the snout near its tip, the tubes not more than half the length of the eye. The gape reaches well beyond the eye, 3.14 to 3.4 in the head. Teeth very small, conical, granular, in two rows on both jaws; those on vomer in 2 rows anteriorly, where they join with the larger teeth on the intermaxillary plate; posteriorly the vomerine teeth form a long single row. Teeth on intermaxillary plate and at tip of lower jaw are larger than the other teeth.

Color brown to dusky brown all over or above only, when the lower parts are pale brown.

Described from the type, 308 mm long, and paratype 303 mm long, taken at the Yacht Harbor, Manila Bay, Luzon.

Related to *Pisoodonophis micropterus* Bleeker, but with different dentition and proportions.

I take pleasure in naming this species in honor of my friend of many years, eminent botanist, founder of the Philippine College of Agriculture at Los Baños, Laguna Province, and great friend of the Philippine people, Dr. E. B. Copeland.

MORINGUA MACROCHIR Bleeker.

Moringua macrochir BLEEKER, Nat. Tijds. Ned. Ind. 19 (1855) 71, Batu Islands; BLEEKER, Atlas Ichth. 4 (1864) 15, *plate 147, fig. 4,* Batu; WEBER and DE BEAUFORT, Fishes Indo-Austr. Arch. 3 (1916) 339, *fig. 166,* Batu Islands; Java; Kei Islands.

Moringua raitaborua GÜNTHER, Cat. Fishes 8 (1870) 90, pro parte; Batu; M. WEBER, Siboga Exped. 57 Fische, p. 52; (not of Buchanan Hamilton).

This little eel has been known hitherto from only a few localities in the East Indies. This is the first Philippine record.

A specimen 275 mm long was taken off Pilas Island, in the Sulu Sea, west of Basilan Island.

The depth is 30.55, the head 11.7 times in the length; the tail is 2.27 times in the head and trunk together and the head is 7.125 in the trunk. The distance between the origin of the anal fin and the anus is 2.3 times in the head. The eye is 9.8 times in the head; the cleft of the mouth extends beneath the hind margin of the eye, 3.6 times in the head. The lower jaw projects beyond the upper. The origin of the dorsal fin is approximately opposite that of the anal. Pectorals small, their length 5.2 in the head.

The conical pointed teeth are in a single row in each jaw, 4 on each maxillary, 3 or 4 pairs of stouter teeth on the intermaxillary. Eight on each mandible; only a single tooth on the vomer.

Color uniform dusky on the back, paler on the sides and becoming pale brown beneath.

The specimen presents several marked differences from the descriptions of *M. macrochir,* notably in its greater depth and in the dentition. Some of the teeth may have been broken off, and the size of the specimen may account for its greater depth. Weber and De Beaufort's specimen was 245 mm long.

PLESIOPS ALTIVELIS Steindachner.

Plesiops altivelis STEINDACHNER, Sitzungsber. Akad. Wien 112 (1903) 17; WEBER and DE BEAUFORT, Fishes Indo-Austr. Arch. 5 (1929) 377, after Steindachner.

This handsome and distinctive *Plesiops* has only been known previously from the type specimen, 160 mm long, collected at Nias, an island off the west coast of Sumatra.

A second specimen, 100 mm long, was taken at Siaton, Negros Oriental Province. The elongate pointed caudal is 1.5 times in the length. The soft dorsal and anal are elongate, pointed, the penultimate rays 2.27 times in the length. The elongate ventral reaches almost to the caudal base, 1.56 times in the length. The body is conspicuously lined, each scale with a white spot, these forming rows alternating with blackish brown stripes. The head is thickly spotted with small white spots, including the jaws, throat, and breast. There are rows of small white spots on the spinous dorsal, anal and the basal part of the soft dorsal. The fins are all deep black except the pectoral; it is colorless, with a broad black crescent on its base.

The conspicuous white spots are blue in life. This is a fine addition to the Philippine fish fauna.

WAKIYUS ABLANI Herre, new species.

Dorsal I–VIII–I–11; anal I–10; pectoral II–12–VII; scales about 53 in lateral series and 4 between the lateral line and the first dorsal spine. The first 2 to 5 scales of the lateral line are spinescent.

The depth is about 7, the head 2.62 to 2.65, the caudal 4.5 times in the length. The breadth of the head is 1.38 to 1.45 times in its own length. The eye is 3.86 times in the head and 1.2 in the short, rounded snout which is 3.2 in the head. The interorbital width is 2.8 times in the eyes. The head is scaleless above, the vertex rugose. No orbital cirrus. The maxillary is a little longer than the eye. The tongue is trilobed. Each anterior nostril has a small flap and a sharp spine near its inner side; the anterior nostrils are tubulated, with 2 or 3 spines in a row along the inner side. There are 3 or 4 spines on the anterior margin of each eye, followed by a bony ridge along the inner margin with 8 or 10 small spines; this ridge continues to the nape, with 6 or 8 larger serrations. A minutely serrate ridge begins before each eye and runs backward outside the eye to terminate in a large strong preopercular spine, below which are 2 or 3 much smaller spines, followed by at least 3 denticulations on the free margin of the preopercle. From the anterior end of this ridge radiate 4 small and minutely serrate ridges. A short finely denticulate ridge extends back from the middle of the posterior margin of the eye to the hind margin

of the preopercle. A longitudinal serrate bony ridge along the middle of the opercle, terminating in a rather strong spine. On each side of the predorsal area the hind margin of the opercle is denticulate; a short spiny and denticulate opercular ridge originating between the orbital and postorbital ridge on the preopercle. A small spine terminates a curved ridge near the inner margin of each opercle. A short strong scapular spine is above the pectoral base. No opercular flap, no interopercular spine, and no antrorse spine.

The predorsal spine is 4.8 in the head or 1.25 times in the eye, and more than half the length of the first dorsal spine; this equals the body depth; the two following spines are longest, 2.25 to 2.6 in the head. The longest anal rays are a little shorter than the longest dorsal spines. The short pectoral is 2.4 times in the head; the ventral extends to the base of the second anal ray. The caudal tip is damaged in my specimens.

The color in alcohol is brown, with 4 dark brown broad cross bands; the head is pale brown above, mottled with darker brown. All the fins except the pale anal are crossbarred with black or dark brown spots. The pale lower lip is barred with brown.

Described from the type, 78 mm long, and 8 paratypes from 77 to 68 mm in length, all taken by a beam trawl in Manila Bay, Luzon, a few miles from Corregidor Island, in 17 to 23 fathoms.

This species is near *Rogadius pristiger* but lacks the antrorse spine of that genus. The number and arrangement of the small to minute spines and serrations of the head also differ not only from those of *R. pristiger* but from all other Platycephalids known from the East Indies and Japan so that it does not fit exactly with any genus from that area.

I take pleasure in naming this interesting fish after my young colleague and friend, Mr. G. L. Ablan, of the Philippine Bureau of Fisheries, to whom I am indebted for many fine specimens from the Gulf of Lingayen, Pangasinan Province, Luzon.

VAIMOSA LAYIA Herre, new species.

Four specimens of a goby believed to be new were collected from a small tidal estero at Layia, Batangas Province, Luzon. They are evidently related to *Vaimosa fusca* Herre, to which they bear some resemblance but from which they differ in important details.

The type is a male, 31 mm long; the paratypes are 3 females, 23 to 29 mm in length.

Dorsal VI–I–8 or 7; anal I–7 or 6; scales in longitudinal series 28 plus 3 or 4 on the caudal base; 10 scales in transverse series and 13 or 14 predorsal scales, the anterior one greatly enlarged and extending into the interorbital area; opercular scales 12; preventral scales very small.

The type has the depth 5.6, the head 3.1, the pectoral 5.15, the broadly rounded caudal 4.4, the first dorsal spine 2.8 times in the length. The eye is 5 times in the head, 1.75 in the interorbital, and 1.4 in the snout. The least depth of the caudal peduncle is 1.5 times in its own length.

The dorsal profile is nearly horizontal the large head somewhat depressed; its breadth 0.7 of its length; the snout broadly rounded; the strongly oblique mouth is of moderate size, the maxillary extending beneath the pupil, the lower jaw very slightly included; three rows of teeth in each jaw, those of the outer row above enlarged, the rest all minute. Three rows of minute sensory papillæ on the cheek between the eye and the angle of the mouth; a vertical row on the opercle near its anterior margin and a short horizontal row from it near its lower end. Dorsals separated by 4 scales, the first dorsal spine greatly elongated and hairlike, reaching to the sixth ray of the second dorsal; the rays of the second dorsal increase in length posteriorly, the last one almost touching the caudal base; the anal rays are similar but shorter, the last ray not reaching the caudal by the breadth of 2 scales. The ventral is rather small, falling much short of the anus.

Females are much like the above, but the body is deeper, the ventral profile more protuberant. The fins are not elongate, the first dorsal not reaching the second dorsal when depressed; the last ray of the second dorsal much short of the caudal when depressed.

The color is pale brown with six blackish-brown cross bands forming a series of X-like markings on the sides, the ground color showing as rows of pale tan spots; a black transverse bar at the caudal base and another on the caudal; opercle largely blackish; first dorsal with a transverse blackish bar; second dorsal with black stripes between the rays; anal brown, the ventral blackish; pectorals clear; caudal may have a cross row of small spots, as well as the bands already mentioned. Most of the scales on the sides and back are margined with dusky or blackish brown, these markings forming the cross bands.

ON THE MORPHOLOGY AND DEVELOPMENT OF THE FEMALE GAMETOPHYTE IN ORYZA COARCTATA ROXB.

By Asoka Kumar Paul
Of the Directorate of Agriculture, State of West Bengal
AND
Robindra Mohon Datta
Of the Jute Agricultural Research Institute, Barrackpore, West Bengal

ONE PLATE

INTRODUCTION

Though a considerable amount of work on the cytology and cytogenetics of several species of *Oryza* was done previously, information regarding the female gametophyte development is restricted to the works of Kuwada(4), Terada(8), and Juliano and Aldama(3), all of whom made studies on *Oryza sativa* and its varieties. Further, Morinaga and Fukushima(5), reported the presence of two megasporangia in an ovary of a haploid rice plant and several megasporangia with two embryo-sac mother cells each. In addition, they detected few embryo-sacs containing an extra synergid in addition to the normal two. But none had done any work on the development of the female gametophyte of *Oryza coarctata,* which grows wild in India.

MATERIAL AND METHODS

The plant was in cultures at the Government Agricultural Farm, Dacca, Bengal, for genetical studies. In any comprehensive study, information regarding the morphology and the cytology of the plant is essential and with that end in view this piece of research was first undertaken in 1936 by one of us (A.K.P.) but due to his departure from India just after the start of this study, the work was held up in abeyance.

The material was fixed in September, 1936, in Allen's Bouin, Licent, and Navashin on sunny days between 10 a. m. and 12 noon and 2 and 4 p. m.; the best results were obtained with Navashin. The usual paraffin method was followed and sections were cut 12 to 22 micra thick according to the stages desired. Gentian violet was used as a stain.

OBSERVATIONS

The carpel is superior solitary with one-celled ovary containing a single ovule within the chamber. The archesporium

is hypodermal in origin as in *Oryza sativa,* (3, 4, and 8) and is differentiated and distinguished in the second layer of the nucellar tissue as a polygonal cell of comparatively larger dimensions with thicker and denser cytoplasm and relatively large nucleus. It is strictly confined to a single cell, as was usually observed by Kuwada(4), in *Oryza sativa.* Juliano and Aldama(3) and Morinaga and Fukushima(5), however, found two such archesporial cells lying side by side in *Inapostol,* a Philippine variety of *O. sativa* and a haploid rice plant respectively. The present writers(2) also observed the same in *O. sativa* var. *plena* (also known as "double rice"). No parietal cell is observed to be cut off and the archesporium acts and functions directly as a megaspore mother cell after nourishment and development (Fig. 1).

The megaspore mother cell undergoes a period of rest before meiosis starts. In the resting stage its nucleus contains one conspicuous nucleolus embedded in the chromatin network. The general cytoplasm is minutely vacuolated throughout at first but bigger vacuoles appear later in the general plasma along with the growth, elongation and development of the cell. Its apex is broader and the lower end is tapering (Fig. 2). After the reduction division a cell-plate is formed about the central region of the cell, thus dividing it and thereby forming two dyads. The second divisions follow simultaneously in both the cells (upper as well as lower) resulting in the formation of a linear tetrad of four megaspores, the morphological nature of which is more or less the same. The homotypic spindles lie parallel to the long axis of the ovule. Kuwada(4), Terada(8), and Juliano and Aldama(3) observed similar type of development in *O. sativa,* though Terada(8) also further reported the formation of three megaspores instead of the normal four in a Japanese variety (*Nioiwase*) of rice.

Some time after, the upper three megaspores show various types of contraction leading to the ultimate degeneration and the chalazal one alone functions. These three upper cells after complete degeneration and disintegration are observed as dark-staining shapeless masses covering and capping the functional and developing megaspore (Fig. 3). This disintegrated cap lasts till the 4-nucleate stage of the sac.

The active megaspore gradually increases and elongates considerably in size. Its nucleus does not divide until the cell increases 2 to 3 times in volume. Its nucleus divides. Several

smaller vacuoles meet and coalesce to form a big central vacuole and its daughter nuclei are thus pushed apart and separated to the polar regions of the sac. Protoplasmic connections, thin and thick, are sometimes seen to interconnect between themselves in the vacuolar region. These two daughter nuclei again divide giving rise to four nuclei, two at each pole. The central vacuole becomes very prominent and the sac increases in size (Fig. 4). These four nuclei further divide simultaneously to reach the eight-nucleate stage of the sac; the quartet being noticed at each pole with a bigger vacuole in the center (Figs. 5 and 6). After the octo-nucleate stage is reached, three nuclei organize the egg-apparatus; three nuclei form the antipodals and the remaining two become the polars.

The egg-apparatus consists of two pyriform synergids and a large oblong egg (Fig. 7). Polar nuclei are a bit larger than the other nuclei of the sac and migrate towards the center. The three antipodals differentiate later as cells and lie at the chalazal end. The present writers have not observed any direct or indirect nuclear divisions in the antipodal nuclei as recorded by Kuwada(4), and Juliano and Aldama(3) in *O. sativa*.

The development of the female gametophyte is of the usual monosporic eight-nucleate (normal) type, as recorded by us(6). The ovule is bitegmic and anatropous at maturity. The haploid chromosome number of this plant from the pollen mother cells was reported by us(6) as 24, though Parthasarathy(7) first reported the diploid chromosome number to be 48. It appears from the list of chromosome numbers, as published by Darlington and Janaki Ammal(1), that these species of *Oryza* have 24, 36 and 48 as the diploid numbers, proving thereby that this genus has a tendency towards polyploidy.

SUMMARY

1. The archesporium is hypodermal in origin and directly acts as a megaspore mother cell.

2. The megaspore mother cell gives rise to a tetrad of four megaspores; the chalazal one being functional.

3. The development of the female gametophyte is of the usual monosporic eight-nucleate (normal) type.

4. Antipodals are formed into cells but no direct or indirect nuclear divisions are observed in them.

In the end, we offer our grateful thanks to Mr. R. L. M. Ghose, botanist and geneticist, Central Rice Research Insti-

tute, Cuttuck, India and Mr. Jyotirmoy Datta, scientific officer, Office of the Dictionary of the Economic Products (C. S. I. R.), Government of India, New Delhi for kindly lending us some valuable literature from their personal libraries.

REFERENCES

1. Darlington, C. D., and E. Janiki Ammal. Chromosome atlas of cultivated plants. London (1945) 351 pp.
2. Datta, R. M., and A. K. Paul. Morphology of the ovary of *Oryza sativa* Linn. var. *plena* (double rice). Science **113** (1951) 491.
3. Juliano, J. B., and M. J. Aldama. Morphology of *Oryza sativa* Linn. Philippine Agric. **26** (1937) 1–134.
4. Kuwada, Y. A cytological study of *Oryza sativa* L. Bot. Mag. Tokyo **24** (1910) 267–281.
5. Morinaga, T., and E. Fukushima. Cytogenetical studies on *Oryza sativa* L. I. Studies on the haploid plant of *O. sativa*. Japanese Jour. Bot. **7** (1934) 73–106.
6. Paul, A. K., and R. M. Datta. Development of the female gametophyte of *Oryza coarctata* Roxb. Sc. and Cult. **15** (1950) 487–488.
7. Parthasarathy, N. Cytological studies in Oryzeæ and Phalarideæ. II. Further studies in *Oryza*. Cytologia **9** (1938) 307–318.
8. Terada, S. Embryological studies in *Oryza sativa* L. Journ. Coll. Agric., Hokkaido Imp. Univ., Sapporo, Japan **19** (1928) 245–260.

ILLUSTRATIONS

Plate 1

Fig. 1. Archesporial cell. × 1200.
2. Megaspore mother cell. × 1200.
3. 2-nucleate embryo-sac with the remnants of degenerated spores at the top. × 1600.
4. 4-nucleate embryo-sac. × 2000.
5. Eight-nucleate embryo-sac (Farly). × 2000.
6. The same as above (More advanced). × 2000.
7. Egg apparatus with an oval egg and two synergids. × 2000.

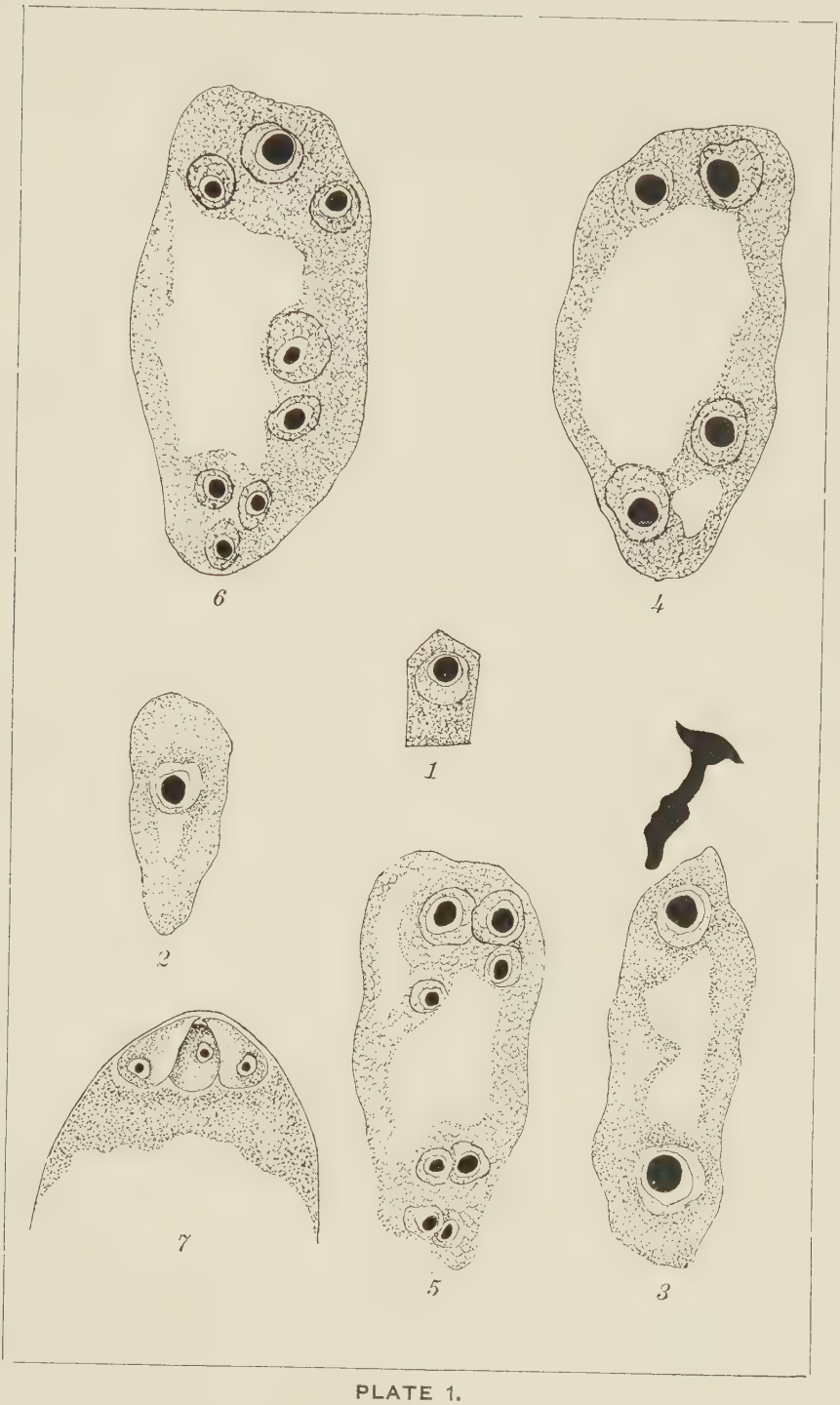


PLATE 1.

RECORDS AND DESCRIPTIONS OF JAPANESE TIPULIDÆ (DIPTERA), PART I

THE CRANE-FLIES OF SHIKOKU, I

By Charles P. Alexander
Of Amherst, Massachusetts

TWO PLATES AND THREE TEXT FIGURES

INTRODUCTION

During forty years of intensive work on the Tipulidæ of the Japanese Empire, numerous records have accumulated and in order to add to our still insufficient knowledge of seasonal and geographical distribution it seems advisable to publish these data. Accordingly I have planned a series of papers to be issued under the present title where the crane-fly fauna of the four major Japanese islands, together with Formosa, will be considered. The species of each individual island will be numbered consecutively throughout the part or parts devoted to them. By such a method it will be possible at any time to determine the total number of species so listed for the island in question and to refer to any particular species by its number in subsequent parts. It is planned to supply the original reference and basic synonymy only in conjunction with the first inclusion of a species and not to repeat this as the same insect is discussed for a different island and at a later date. Keys to the various genera and species will be provided in the fascicles covering the eastern Palaearctic species of the family being prepared by the writer for Erwin Lindner's great work *Die Fliegen der Palaearktishen Region* (Stuttgart).

The Japanese Empire is divided politically in two different manners or categories, the more ancient usage being into Prefectures (Ken), the more recent (since 1871) into Provinces (Kuni). For greater exactness in this series of papers I am using the latter category. As was explained to me many years ago by my dear friend Professor Teiso Esaki, distinguished Head of the Entomological Laboratory of Kyushu University, Fukuoka, zoogeographers in Japan prefer the use of Provinces for the following reasons:

1. More accurate than Prefectures (73 instead of 47).
2. More dependent on geographical features.
3. Always different from the names of cities or towns included in them.

Hokkaido constitutes one of the 47 Prefectures, being further subdivided into 14 sub-Prefectures. As regards Shikoku, this is divided into four Provinces that correspond exactly in boundaries to four Prefectures, as follows: *Awa* (Tokushima); *Iyo* (Ehime); *Sanuki* (Kagawa), and *Tosa* (Kochi). Place names will be spelled in accordance with usage recommended by the National Geographic Society, following their latest and most detailed map.[1] Marked variation is shown in the spelling of Japanese place names, as for example, Shikoku or Sikoku; Mount Ishizuchi, highest mountain in the latter island, spelled variously Ishitsuchi, Ishizuchi or Isizuti.

From its geographical position along the eastern coast of Asia and extending southward almost to the 30th parallel of North Latitude, the Japanese islands possess a most intriguing combination of elements in the Tipulidæ, the most interesting of which are as follows:

1. *Species derived from the west-Europe and western Asia.*—As has been indicated in other papers, certain European crane-flies extend across Eurasia and into the Japanese islands unchanged or virtually so. Others, while evidently at least subspecifically distinct, show unquestioned affinities with the western Palaearctic region. In such cases the spread of the group or species in question may have been from Japan and eastern China westward into Europe, or in the reverse direction, depending upon the center of origin. Very probably certain of the groups of crane-flies characteristic of the European fauna had their origins in eastern Eurasia, as for example, *Dictenidia*, *Tipula* (*Acutipula*), *Limnophila* (*Adelphomyia*), and others.

2. *Species derived from the east.*—Alaska and Arctic North America. As is well known, during geologic time the narrow Bering Strait has proved scarcely to be a barrier to the free dispersal of most forms of plant and animal life, this including the Tipulidæ. A number of species have spread over the entire north temperate region and thus have a true Holarctic distribution but a very few others seem to have spread more locally across Bering Strait, either from North America to Japan or in the reverse direction.

3. *Species derived from the south.*—The Oriental fauna is well represented in Japan, particularly at the lower altitudes and in some instances has spread farther to the north along the

[1] National Geographic Society, Washington, D. C. Map of Japan and Korea. National Geographic Magazine, December, 1945.

mainland, as to the Ussuri country in Siberia or even beyond. The most conspicuous of these Oriental groups are *Pselliophora, Limonia* (*Libnotes*), *Limonia* (*Thrypticomyia*), *Conosia, Trentepohlia, Gymnastes,* and *Styringomyia.*

4. *The endemic fauna.*—Many of the species, particularly in the mountains, appear to be restricted to the islands. A considerable number of other forms recur in Korea and Manchuria, while a few others extend far to the south, usually at higher and higher altitudes in the mountains.

There are a few genera that from their known distribution might be expected to occur in Japan yet have not been taken to this date, the most noteworthy being *Phyllolabis* Osten Sacken. This includes rather numerous species in western China and the Himalayas and about a dozen others in western North America, a distribution that might well include Japan. Another missing element that from its known range in Eurasia might be expected in Japan is *Thaumastoptera.* Groups that are well represented in these islands and in North America but not or only poorly in Europe include *Limnophila* (*Prionolabis*), *Limnophila* (*Dicranophragma*), *Ulomorpha, Hexatoma* (*Eriocera*), *Cladura,* and others. Attention should also be called to the subgenus *Oropeza,* genus *Dolichopeza,* which has a type of distribution shown by many plant genera and species occurring in eastern North America and again in Japan and eastern Asia while being quite lacking in western North America.

As a brief summary, the following generic and subgeneric groups include those most characteristic of the Japanese fauna.

Tipulinæ. *Dolichopeza, Nephrotoma, Tipula, Ctenophora, Dictenidia, Tanyptera.* From the south: *Ctenacroscelis, Pselliophora, Tipula* (*Tipulodina*), *Tipula* (*Indotipula*). From the north and west: *Tipula* (*Vestiplex*), *Tipula* (*Oreomyza*).

Cylindrotominæ. *Liogma, Triogma, Cylindrotoma.*

Limoniinæ.

Limoniini. *Limonia* (*Limonia*), *Limonia* (*Discobola*), *Limonia* (*Discranomyia*), *Limonia* (*Geranomyia*), *Antocha, Elliptera, Helius, Dicranoptycha.* From the south: *Limonia* (*Libnotes*), *Limonia* (*Thrypticomyia*), *Limonia* (*Euglochina*).

Pediciini. *Pedicia* (*Pedicia*), *Pedicia* (*Tricyphona*), *Dicranota* (*Dicranota*), *Dicranota* (*Eudicranota*), *Dicranota* (*Rhaphidolabis*), *Ula.* From the south and endemic: *Heterangæus, Nipponomyia.*

Hexatomini. *Paradelphomyia, Epiphragma, Austrolimnophila, Pseudolimnophila, Dactylolabis, Limnophila* (*Eutonia*), *Limnophila* (*Limnophila*), *Limnophila* (*Adelphomyia*), *Limnophila* (*Prionolabis*), *Limnophila* (*Phylidorea*), *Limnophila* (*Elæophila*), *Limnophila* (*Dicranophragma*), *Pilaria, Hexatoma* (*Eriocera*). From the east:

Ulomorpha. From the south: *Atarba* (*Atarbodes*), *Elephantomyia* (*Elephantomyia*), *Elephantomyia* (*Elephantomyodes*).

Eriopterini. *Cladura, Chionea, Gnophomyia, Gonomyia, Lipsothrix, Rhabdomastix, Erioptera* (*Erioptera*), *Erioptera* (*Psiloconopa*), *Erioptera* (*Empeda*), *Ormosia, Molophilus.* From the south: *Conosia, Trentepohlia, Gymnastes, Styringomyia.*

Our knowledge of the Tipulidæ of the Japanese Empire has been developed through the friendly interest and cooperation of very many entomologists and collectors who are named in the historical account following this introduction. My deepest and heartfelt thanks are extended to these many friends and colleagues for their vastly appreciated assistance in making known the rich crane-fly fauna of their country. Through their generosity the types of various new species are preserved in my collection.

HISTORICAL DEVELOPMENT OF OUR KNOWLEDGE OF THE CRANE-FLIES OF JAPAN

THE NINETEENTH CENTURY

Prior to the coming of Commodore Perry to Japan in 1853 there seems to be no single record of any member of this family of flies from any part of the Empire. In 1858, Loew [2] described as new two species of the genus *Tipula* (as *japonica* and *parva*), that unfortunately have not been definitely recognized in recent years. In 1876, Westwood [3] described two further species, captured by Fortune (*Ctenacroscelis mikado,* as *Tipula; Limnophila satsuma,* as *Limnobia*), both of which are now known to be widely distributed in the islands. The next addition to our knowledge came following the World's Columbian Exposition in Chicago, 1893, when Professor Mitsukuri, in charge of the exhibit of natural history objects from Japan, generously presented these materials to the United States National Museum. As concerns the Diptera, which were treated in an important paper by Coquillett,[4] these totalled 124 species of which no fewer than 54 were new; in the Tipulidæ, 9 species, with 5 new. Of interest is the estimate given by Coquillett that there were possibly about 1,000 species of Diptera to be expected in Japan, a preposterously low figure that may well be found to be equalled in the Tipulidæ alone when the fauna is fully known, particularly if Formosa is included in this count. Early collectors whose

[2] Loew, Hermann. Wien. Ent. Monatschrift 2 (1858) 101–102.
[3] Westwood, J. O. Ent. Soc. London Trans. (1876) 504–505.
[4] Coquillett, D. W. U. S. Nat. Mus. Proc. 21 (1898) 301–340.

materials are to be found in various European museums included Leech, Drouart de Lezey, Hilgendorf, and others. In the Japanese fauna there occur various other crane-flies described by older authors (as *Conosia irrorata* Wiedemann) but such forms were described from other countries and were found in Japan at a later date.

THE TWENTIETH CENTURY

The first paper to be published in this later period was one entirely in Japanese by the distinguished entomologist, Doctor Shonen Matsumura [5] in 1905, wherein two new species were included, these being *Ctenophora yezoana* and *Tipula longicauda*.

In 1912 I received from the late Dr. S. I. Kuwana an extensive series of Japanese crane-flies, virtually all from the immediate vicinity of Tokyo, that were described in 1913 and 1914 [6] and constituted a basis for subsequent work on the fauna. In 1916 Matsumura [7] published his second and major contribution to the subject, describing several new genera and species, some of which have subsequently fallen into synonymy or been reduced to subgeneric status, though most of the species are valid and include some of the most conspicuous elements in the Japanese tipulid fauna. Matsumura served on the staff of the Hokkaido University from the time of his graduation there in 1895 until his retirement as emeritus professor in 1934. During this long period and following his retirement Matsumura published a vast amount of work on the insect fauna of Japan.[8] He now lives in Tokyo, where he celebrated his 80th birthday on March 6, 1952.

In 1917 I became acquainted with Akio Nohira who earlier had sent materials to Matsumura and through him obtained several of the species described by the latter, including virtual paratypes of certain of the species. In 1919, through Ryoichi Takahashi, large and important series of these flies became

---

[5] Matsumura, Shonen. Thousand Insects of Japan 2 (1905) 121–124, *pl. 29, figs. 5, 6.*

[6] Alexander, C. P. Canad. Ent. 45 (1913) 197–210, 285–295, 313–322; 46 (1914) 157–164, 205–213, 236–242.

[7] Matsumura, Shonen. Thousand Insects of Japan, Additamenta 2 (1916) 447–474, *pl. 24, figs. 10–17; pl. 25, figs. 1–13.*

[8] List of publications of Dr. S. Matsumura in entomology. Matsumushi 3 (1949) 94–96, 125–128; portrait. (Commemoration numbers dedicated to Matsumura on the occasion of his seventy-seventh birthday; Insecta Matsumurana Association, Entomological Institute, Hokkaido University.)

Uchida, T., and C. Watanabe. Brief account of life of Matsumura. Insecta Matsumurana 17 (1949) ii.

available, chiefly from near Tokyo and from Chichibu, in the nearby mountains of Saitama. At this same time correspondence began with Cho Teranishi, Kichizo Takeuchi, and especially with Satoru Kuwayama, distinguished economic entomologist of the Hokkaido Agricultural Experiment Station.

In 1920 and shortly thereafter, friendship began with Teiso Esaki, Jiro Machida, Tokuichi Shiraki, and others of the leading entomologists of Japan. Of extreme importance were the collections of Esaki (Hokkaido and Karafuto, 1922; Formosa, 1923; Central Honshu, 1923; Japanese South Pacific Mandated Islands, 1936–1938; Shikoku, 1951; as well as collections throughout Kyushu), Machida (abundant materials from the mountains near Tokyo and from the Japanese Alps) and Shiraki, who for much of his life was chief entomologist at the Agricultural Experiment Station in Formosa and the country's outstanding student of the Diptera (earliest materials from Formosa, collected by Nitobe and himself, were sent to Edwards; later series, from 1920 on to me, including specimens chiefly from Formosa and Honshu). In 1923 and thereafter, extensive collections were received from S. Sakaguchi, then residing in Okinawa, including materials from the Ryukyus islands and later from Kii and Yamoto, Honshu. Other correspondents and colleagues of this period of the mid-1920's included Naoto Ishimori and Kota Monzen, of Morioka; Chukichi Harukawa, of the Ohara Institute, Kurashiki; Hiroshi Hori, of Kukuoka; Tenji Uye, in Oitaken, Kyushu, and some others.

In 1927 there began a long friendship and correspondence with Syuti T. Issiki, who has added vastly to our knowledge of the Tipulidæ of Formosa, especially of the higher mountains, and has also collected in virtually all parts of the main islands of Japan (Hokkaido, Honshu, Shikoku and Kyushu, including Yakushima). In recent years, Issiki has collected in northern Honshu and in Shikoku, as recorded elsewhere in this report.

During the decade that began about 1930, new correspondents included especially Masaaki Tokunaga, brilliant student of the Diptera and author of 85 papers concerning them, including several of unusual value on the Tipulidæ and other families of crane-flies. Since 1951 Tokunaga has been Dean of the Agricultural College of Saikyo University. I am indebted to Hiromu Yamamoto, who secured valuable materials in Rikuchiu Province in 1935 and again in 1947. Others of this decade included in Korea, Jujiro Masaki, Tabashi and Takeya; in Honshu, Takeo Kato, in Morioka; Hibi, in Hoki Province,

especially Mount Daisen; K. Imanishi, K. Kamiya, Toyoji Nakamura, Masuzo Ueno, and others, chiefly in the Japanese Alps, Bunkichi Oda and K. Yokouchi; in Hokkaido, Ichiji Okada, who made important studies on the Mycetophilidæ and other families in the Nematocerous Diptera.

Special acknowledgement is made to Shojiro Kariya, whose early work on the Japanese Tipulidæ was outstanding, and who generously presented me with extensive series of Tipulidæ, chiefly from Honshu and Hokkaido, prior to his going to Manchuria in January, 1935, where he remained until 1945.

In this same decade, materials were received from D. Miyadi, taken in the northern Kurils (Chishima Retto) in 1934. Important series of these flies came from Mr. E. Suenson, of Shanghai, taken at Unzen, in Kyushu, and at Kamikochi in the northern Alps, as well as in eastern China. Particular attention is called to the work of Alexander M. Yankovsky in northern Korea, between 1937 and 1941, briefly discussed by me in another paper.[9] These collections are incomparably the finest series of Tipulidæ ever taken in Korea. In July and August 1940, Doctor Kuwayama and Y. Sugihara secured an interesting series of these flies in the southern Kurils, on the islands of Kunashiri and Etorofu, the results of which will be published by Kuwayama. Dr. J. Linsley Gressitt collected abundant materials in various parts of China and Japan, both before and following World War II. His materials from Formosa and the Ryukyus (Ishigaki and Iriomote, in Yaeyama Retto) are of particular value in this survey.

With the oncoming of the war, all such work and progress ceased abrubtly but following the close of hostilities, friendship and correspondence were resumed with many of the above named colleagues. Among the younger workers of the present decade, particular thanks are due to Syusiro Ito, who while associated with Issiki, has made very important collecting trips to Shikoku and to northern Honshu. Ito has published on the Tipulidæ and still earlier on the Rhopalocera; at present he is undertaking detailed work on the Japanese Trypetidæ. Mr. Eiji Kawase, of Niigata, has made important collections in his vicinity and generously sent his materials to me for study. He is engaged in a study of the biology and distribution of the family. Toshiro Haruta and Hiroshi Inoue collected materials on Mount Takao, near Tokyo, while the latter made large and

[9] Alexander, Charles P. Royal Ent. Soc. London Trans. 95 (1945) 227–228.

valuable collections in the northern Alps in the summer of 1951. Of particular interest and value to the present study is the work of members of the Matsuyama Agricultural College and Shikoku Entomological Society, particularly Professor Tamotsu Ishihara and his colleagues Mutsuo Miyatake and Toshiro Yano, together with further students who are mentioned later in the report. Dr. Siro Kitakami, authority on the Blepharoceridæ, has collected in many parts of Japan and elsewhere in Asia.

With the occupation of Japan and Korea by American troops following the war, it was expected that abundant materials in this family of flies might be collected by such American entomologists. This did not prove to be the case and only small collections have become available from this source, chiefly through the interest of two former students, Dr. Sol Kramer, in Korea, and Major Hanssen Schenker, in Honshu.

A summary of the principal collectors in the various parts of the former Japanese Empire is as follows:

Manchuria—Michael Weymarn and associated Russian entomologists; very large and valuable series, still chiefly unworked.

Korea—Yankovsky; Kitakami; Machida, Masaki, Tabashi, Takeya; Kramer.

Kurils—Miyadi; Kuwayama, Sugihara.

Karafuto—Esaki, Kitakami, Kuwayama, Paul Labbé.

Hokkaido—Esaki, Hori, Issiki, Kitakami, Kuwayama, Matsumura.

Honshu—Esaki, Inoue, Issiki, Ito, Kawase, Kariya, Kato, Kuwana, Oda, Machida, Sakaguchi, Suenson, Takahashi, Takeuchi, Teranishi, Tokunaga, Yamamoto; Hibi, Imanishi, Ishimori, Kitakami, Masaki, Monzen, Mutuura, Nakahara, Okada, Shiraki, Tanaka, Ueno, Yuasa.

Shikoku—Harukawa, Ishihara, Issiki, Ito, Miyatake, Mutuura, Yano; Esaki, Hagimori, Ishimaru, Kobayashi, Koyama, Tomari, Yatsuzuka.

Kyushu—Esaki, Hori, Issiki, Kitakami, Suenson, Yasumatsu; Cho, Fujino, Hashimoto, Takeya, Torikata, Uye.

Ryukyus—Sakaguchi; Gressitt, Issiki.

Formosa—Esaki, Gressitt, Inamura, Issiki, Kitakami, Maa, Maki, Nitobe, Shiraki, Sonan, Takahashi, Takeuchi, Wileman, Yoshino.

Japanese Mandated South Sea Islands (Palau, Caroline and Marianna Groups)—Esaki, Murakami; Fulloway, Swezey, Dybas.

I have never had the privilege of corresponding with Matsumura but many others of the leading entomologists of Japan have been friends and correspondents during the past forty years. A few I have met personally, Nakahara and Yuasa while students in American universities; Esaki, Ishimori and Kuwayama while on visits to America, including Amherst.

In summarizing the past and present work on the Tipulidæ of Japan, attention should be directed to Mr. Shozaburo Yama-

mura, whose life had been discussed by me in an earlier paper.[10] Yamamura was only 21 years of age when he died in Korea (in 1915) yet already had given decided promise of becoming a leading student of the group. Other native students, in addition to Matsumura, who have published important papers on the taxonomy of the group include Ito, Kariya, Masaki, and, especially, Tokunaga. A great amount of work has been accomplished on certain economic species, particularly on the biology and control of *Tipula* (*Yamatotipula*) *aino* Alexander, ranked by Kuwayama as being among the ten leading pests of rice in Japan. Apparently the earliest paper on this pest was one by S. Onuki, published in 1905, while perhaps the latest was the well prepared report on the fly, its ecology and control, in Toyama by H. Sekiya in 1950, its young author dying this same year. Other students who have done work on various phases of the group include Okada, who studied the species occurring in fungi; Kawase, Masaki, and Hiroo Sugawara. It is to be hoped and expected that very important work will be accomplished in the future by the group of brilliant young workers who have already made such excellent beginnings. I would emphasize the great importance of detailed work that is needed on the biology and ecology of virtually all of the Tipulidæ of Japan. Except for the oustanding work by Tokunaga on the marine Tipulidæ, and by other authors on the economic species such as *Tipula aino* and *Nephrotoma virgata*, scarcely anything has been published on this wonderfully interesting fauna. It is certain that some very striking life histories remain to be discovered among the Japanese Tipulidæ. As a basis for such studies, interested students may consult the papers by Tokunaga, or an early report by the present writer.[11] For more advanced students, attention is called to the detailed reports on the tipulid fauna of eastern North America by Dr. J. Speed Rogers, Director of the Museum of Zoology, University of Michigan, Ann Arbor, Michigan, or by Mr. George W. Byers, of the same address, who has done outstanding work on the American species of the genus *Dolichopeza*. Doctor Rogers has found and reared a considerable proportion of the species

[10] Alexander, Charles P. New and little-known Tipulidæ from eastern Asia (Diptera), part I. Philip. Jour. Sci. 31 (1926) 363–383.

[11] Alexander, Charles P. The crane-flies of New York. Part II. Biology and phylogeny. Cornell University (N. Y.) Memoir 38 (1920) 691–1133, *pls. 11–97.*

occurring in eastern North America, including all critical genera and subgenera.

In concluding this brief history of work on the Japanese Tipulidæ two further subjects should be noted. The first concerns certain local lists that have been published that include numerous distribution records that need not be repeated. The second matter concerns the illustrations of the various species that are available in various major publications in Japan.

All of the local lists above mentioned were published in the *Philippine Journal of Science* in connection with descriptions of new species, appearing between 1924 and 1934. These lists include the following stations:

Karafuto and Hokkaido—Philip. Jour. Sci. 24 (1924) 531–534, including the itinerary of Teiso Esaki. Issiki collections 53 (1934) 267.

Honshu—Japanese Alps (Shinano), collections by Machida and Nakamura 44 (1931) 339–340; 51 (1933) 369–370; Shimotsuke, collections by Issiki 53 (1934) 268; Kazusa, materials taken by Bunkichi Oda 53 (1933) 370.

Kyushu—Kirishima collection by Issiki 42 (1930) 507–508; Yakushima, by Issiki 42 (1930) 508.

Formosa—Arisan, Issiki 42 (1930) 508–509; Hassensan, Issiki 43 (1930) 507–509.

The second subject, of illustrations available in Japanese works, concerns, in the first instance, two important works by Matsumura.

Thousand Insects of Japan, 12 volumes; Basic 4, Additamenta 4, Supplementa 4. The volume that concerns the Tipulidæ is Additamenta 2, published in 1916, as already mentioned. In this, Matsumura describes and figures 20 species, of which 18 are considered as being new. The present arrangement of these species is as follows:

Pselliophora hoppo MATSUMURA, l.c., pp. 447–448, *pl. 24, fig. 11* (whole ♂) ..... *Pselliophora.*

Dictenidia horikawæ MATSUMURA, l.c., pp. 449–450, *pl. 24, fig. 12* (whole ♂) ..... *Pselliophora.*
(synonym of *bifascipennis* BRUNETTI, 1911.)

Xipbusa jozana MATSUMURA, l.c., pp. 450–451, *pl. 24, fig. 13* (whole ♀). *Tanyptera.*
(Probably same as *Tanyptera macra* LOEW, in Matsumura 1911).

Ctenophora nohiræ MATSUMURA, l.c., pp. 451–453, *pl. 24, fig. 14* (whole ♂) ..... *Ctenophora.*
(includes *C. hilgendorfi* ENDERLEIN, 1921).

Ctenophora isshikii MATSUMURA, l.c., pp. 453–454, *pl. 24, fig. 15* (whole ♀) ..... *Ctenophora.*

Ctenophora biguttata MATSUMURA, l.c., pp. 454–455, *pl. 24, fig. 16* (whole ♀) ..... *Ctenophora.*

Formotipula holoserica MATSUMURA, l.c., pp. 455–547, *pl. 24, fig. 17* (whole ♂) ..... *Tipula* (*Formotipula*).

Nippotipula nubifera COQUILLETT, l.c., pp. 457–458, *pl. 25, fig. 1* (whole ♀) ..... *Tipula* (*Nippotipula*) *coquilletti* Enderlein.

Platytipula moiwana MATSUMURA, l.c., pp. 458–459, *pl. 25, fig. 2* (whole ♀) ..... *Tipula* (*Tipula*) *moiwana* Matsumura.

Tipula quadrifasciata MATSUMURA, l.c., pp. 459–460, *pl. 25, fig. 3* (whole ♀) ..... *Tipula* (*Oreomyza*) *quadrifasciata* Matsumura.

Yamatotipula nohiræ MATSUMURA, l.c., pp. 460–462, *pl. 25, fig. 4* (whole ♀) ..... *Tipula* (*Yamatotipula*) *nova* Walker.

Daimiotipula daimio MATSUMURA, l.c., pp. 462–464, *pl. 25, fig. 5* (whole ♀) ..... *Pedicia* (*Pedicia*) *daimio* (Matsumura).

Togotipula pulverosa MATSUMURA, l.c., pp. 464–465, *pl. 25, fig. 6* (whole ♀) ..... *Longurio* (*Longurio*) *pulverosa* (Matsumura).

Pachyrhina makiella MATSUMURA, l.c., pp. 465–466, *pl. 25, fig. 7* (whole ♀) ..... *Nephrotoma makliella* (Matsumura).

Libnotes undulatus MATSUMURA, l.c., pp. 467–468, *pl. 25, fig. 8* (whole ♀). *Limonia* (*Libnotes*) *undulata* (Matsumura).

Eriocera morosa OSTEN SACKEN, l.c., p. 468, *pl. 25, fig. 9* (whole ♂). *Hexatoma* (*Eriocera*) *morosa* (Osten Sacken).

Eriocera alboguttata MATSUMURA, l.c., pp. 468–469, *pl. 25, fig. 10* (whole ♀) ..... *Hexatoma* (*Eriocera*) *alboguttata* (Matsumura).

Globericera moriokana MATSUMURA, l.c., pp. 469–471, *pl. 25, fig. 11* (combined figure, body ♀, antennæ ♂). *Hexatoma* (*Eriocera*) *moriokana* (Matsumura).

Gagamba takei MATSUMURA, l.c. ,pp. 471–473, *pl. 25, fig. 12* (whole ♂). *Limnophila* (*Eutonia*) *satsuma* (Westwood).

Ptychoptera scutellaris MATSUMURA, l.c., pp. 473–474, *pl. 25, fig. 13* (whole ♀) ..... *Ptychoptera scutellaris* Matsumura.

Matsumura, among several other books on the insects of Japan, likewise published *6,000 Illustrated Insects of Japan Empire* (6,085 species; 6,768 figures; 10 colored plates; 1,496 pp.; in Japanese).

A further major work published in Japanese but with excellent figures of thousands of insects is by Teiso Esaki and 24 other authors. This is the *Nippon Konchu Zukan* (*Iconographia Insectorum Japonicorum*), the first edition of which appeared in 1932. A second revised edition has now been prepared (1950). The Tipulidæ that are illustrated in the first edition are as follows:

Dolichopeza (*Nesopeza*) *albitibia* (Alexander)
Dolichopeza (*Nesopeza*) *geniculata* (Alexander)
Dolichopeza (*Oropeza*) *candidipes* (Alexander)
Dolichopeza (*Oropeza*) *satsuma* (Alexander)
Pselliophora isshikii (Matsumura)

Tanyptera jozana (Matsumura)
Dictenidia pictipennis fasciata Coquillett
Ctenophora nohiræ Matsumura
Ctenacroscelis mikado (Westwood)
Longurio pulverosa (Matsumura)
Longurio rubriceps Edwards
Nephrotoma virgata (Coquillett)
Nephrotoma sinensis (Edwards)
Nephrotoma cornicina (Linnæus)
Nephrotoma minuticornis (Alexander)
Nephrotoma takeuchii Alexander
Nephrotoma stygia Alexander
Tipula (*Oreomyza*) *quadrifasciata* Matsumura
Tipula (*Indotipula*) *yamata* Alexander
Tipula (*Schummelia*) *nipponensis* Alexander
Tipula (*Yamatotipula*) *aino* Alexander
Tipula (*Yamatotipula*) *latemarginata* Alexander
Tipula (*Oeomyza*) *taikun* Alexander
Tipula (*Acutipula*) *bubo* Alexander
Tipula (*Acutipula*) *kuzuensis* Alexander
Tipula (*Acutipula*) *turbida* Alexander
Tipula (*Yamatotipula*) *nova* Walker
Tipula (*Tipula*) *moiwana* (Matsumura)
Tipula (*Nippotipula*) *coquilletti* Enderlein
Cylindrotoma japonica Alexander
Triogma kuwanai (Alexander)
Liogma serraticornis Alexander
Limonia (*Libnotes*) *nohiræ* Alexander
Limonia (*Metalimnobia*) *annulus truncata* Alexander
Limonia (*Limonia*) *nubeculosa* Meigen (as *subnubeculosa* Alexander)
Limonia (*Limonia*) *neonebulosa* Alexander
Limonia (*Libnotes*) *nigriceps* (van der Wulp)
Limonia (*Limonia*) *tanakai* Alexander
Limonia (*Limonia*) *angustistria* Alexander
Limonia (*Dicranomyia*) *mesosternata* Alexander
Limonia (*Dicranomyia*) *takeuchii* (Alexander)
Limonia (*Dicranomyia*) *immodestoides* (Alexander)
Limonia (*Dicranomyia*) *takahashii* (Alexander)
Limonia (*Rhipidia*) *lecontei* (Alexander), subsp. (as *maculata* Meigen)
Antocha (*Proantocha*) *serricauda* Alexander
Antocha (*Antocha*) *satsuma* Alexander
Helius tenuirostris Alexander
Pedicia (*Pedicia*) *daimio* (Matsumura)
Pedicia (*Tricyphona*) *grandior* (Alexander)
Nipponomyia trispinosa Alexander
Dicranota (*Rhaphidolabis*) *gibbera* (Alexander)
Epiphragma subfascipennis Alexander
Epiphragma subinsignis Alexander
Pseudolimnophila inconcussa (Alexander)
Limnophila (*Limmophila*) *japonica* Alexander
Limnophila (*Eutonia*) *satsuma* (Westwood)

Limnophila (*Elæophila*) *formosa* Alexander
Limnophila (*Elæophila*) *formosa* Alexander
Limnophila (*Prionolabis*) *auribasis* Alexander
Hexatoma (*Eriocera*) *longifurca* (Alexander)
Hexatoma (*Eriocera*) *lygropis* (Alexander)
Hexatoma (*Eriocera*) *moriokana* (Enderlein)
Elephantomyia (*Elephantomyia*) *hokkaidensis* Alexander
Conosia irrorata (Wiedemann)
Dasymallomyia signata Brunetti
Atarba (*Atarbodes*) *pallidicornis* Edwards
Gymnastes flavitibia (Alexander)
Gymnastes shirakii Alexander (apparently in error)
Ormosia takeuchii Alexander
Ormosia tokionis Alexander
Erioptera (*Psiloconopa*) *asiatica* Alexander
Erioptera (*Psiloconopa*) *asymmetrica* Alexander
Erioptera (*Symplecta*) *hybrida* (Meigen)
Gonomyia (*Idiocera*) *subpruinosa* Alexander
Ptychoptera japonica Alexander

THE ISLAND OF SHIKOKU

Shikoku is the smallest of the four major Japanese islands, totalling about 7,000 square miles. The land is mostly of low relief, with only about one-quarter of the area exceeding

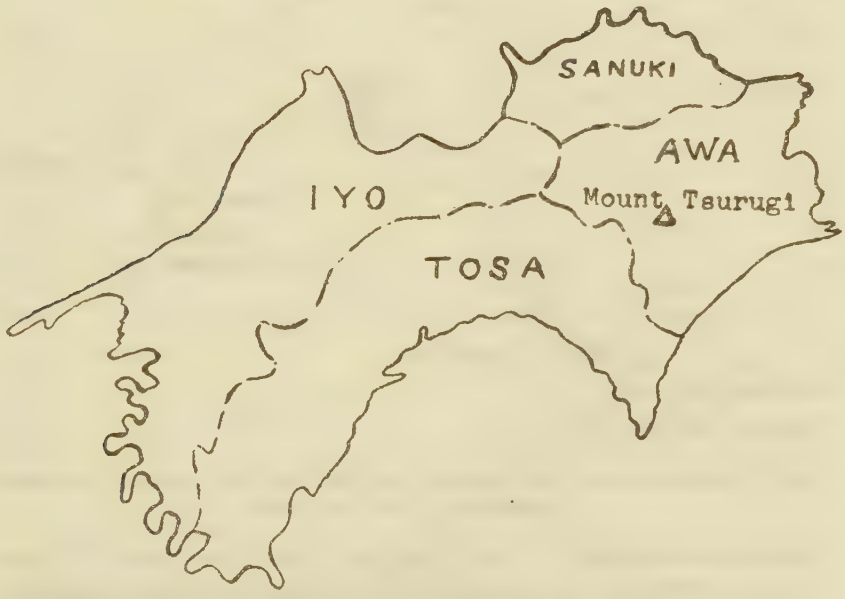


FIG. 1. Outline map of Shikoku, showing the four provinces.

800 meters. The mountains are mainly of crystalline schists, with two summits exceeding 1,950 meters (Ishizuchi, in Iyo, 1,981 meters; Tsurugi, in Awa, 1,955 meters). According to Lyde [12] this mountain fold is a direct continuation of the Nan-shan (Himalayas) while the more northern or Chugoko fold, in northwestern Honshu, with marginal cones such as Daisen, Dogo and Azuma, is a continuation of the Tsin-ling (Kun-lun). This may explain in part certain peculiarities of the crane-fly fauna that are beginning to appear as detailed collections come to hand. Shikoku lies just south of the western peninsula of Honshu, being separated therefrom by the narrow Seto Naikai (Inland Sea).

As regards its crane-fly fauna, Shikoku until very recently had been the least known of the major Japanese islands. The earliest materials in this group were taken by Harukawa in August, 1925, chiefly on Mount Ishizuchi, and included one or two species that have not yet been rediscovered. In May and June, 1950, Issiki and Ito made a very important collection of crane-flies, chiefly centering around these two highest mountains, Ishizuchi and Tsurugi, as shown by the itinerary added later. In 1951, Issiki, Ito, and Mutuura returned to

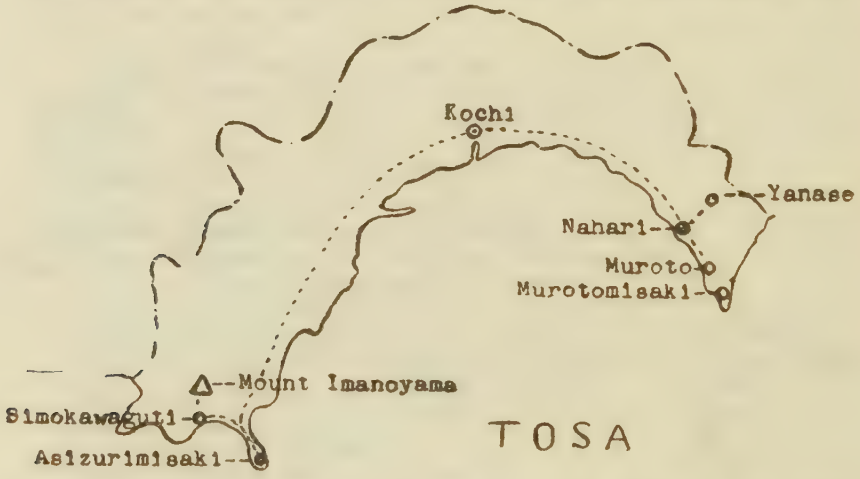


FIG. 2. Outline map of Province of Tosa, showing the route of the Issiki-Ito-Muturra 1951 Expedition.

Shikoku, collecting in Tosa Province from May 1 to 13. Particular attention was devoted to Mount Imanoyama in southern Tosa, where for some years preceding Issiki had suspected

[12] Lyde, Lionel W. The continent of Asia. N. Y., Macmillan (1933) i–xxii, 1–777 pp., 143 figs.

certain peculiarities of the insect fauna, since while the mountain is of low altitude (865 meters) it is situated on the southwestern peninsula of the island and isolated from the major mountains to the north. It is covered with a dense forest of broad-leaved hardwoods which were not destroyed in the recent war. Issiki found peculiarities in the Micropterygidæ (Lepidoptera) and in the Panorpidæ (Mecoptera), groups in which he had made special studies. In the Tipulidæ, a few species were taken only on and near this mountain but at this early date it is inadvisable to make any further generalizations. On this same trip, materials were taken in southeastern Tosa, particularly in the vicinity of Yanase, where some further interesting species were taken. The itinerary of the 1951 trip is shown on the sketch map provided by Professor Ito.

COLLECTIONS OF SYUTI ISSIKI AND SYUSIRO ITO

May 29 to June 11, 1950

Date	Province	Localities
May 29	*Awa* (Mount Tsurugi and vicinity)	Kawati, on Mount Tsurugi, 400 meters
May 30		Kawati to Minokosi, 1,400 meters
May 31		Mount Tsurugi, 1,400 to 1,955 meters
June 1		Minokosi (1,400) to Nagoro (900 meters)
June 2		Nagoro, 900 meters
June 3		Nagoro to Sugeoi
June 4		Sugeoi
June 5		Otiai
June 6		Kyozyo
June 7	*Iyo* (Mount Ishizuchi and vicinity)	Koguti, 300 meters
June 8		Koguti to Mount Ishizuchi 1,400 meters
June 9		Mount Ishizuchi, 1,400 to 1,981 meters
June 10		Mount Ishizuchi, 1,400 meters
June 11		Mount Ishizuchi (1,400) to Koguti (300 meters)

COLLECTIONS OF SYUTI ISSIKI, SYUSIRO ITO AND AKIRA MUTUURA

May 1–13, 1951

(All in the Province of Tosa)

Date	Locality	Altitudes
May 1	Nahari	
May 2	Totidani, near Yanase	300 to 400 meters

Date	Locality	Altitudes
May 3	Nisigawa, near Yanase	700 to 1,000 meters
May 4	Nisigawa to Kokusen, near Yanase	500 to 700 meters
May 5	Kokusen, near Yanase	500 meters
May 6	Murotomisaki	
May 7	Muroto	
May 10	Asizuri-misaki, Simokawaguti	
May 11	Iwai, near Imanoyama	100 to 200 meters
May 12	Mount Imanoyama	200 to 865 meters
May 13	Iwai, near Imanoyama	200 to 100 meters

A further major addition to our record of Shikoku Tipulidæ was received from Professor Tamotsu Ishihara, of the Matsuyama Agricultural College, based on collections made by himself and other staff members and students, particularly Professor Mutsuo Miyatake and Yoshiro Yano. Most of these specimens were taken in Iyo and chiefly in the vicinity of Matsuyama but with important materials from the mountains and mountain passes south and southeast of Matsuyama. A sketch map supplied by Ishihara showing the relative positions of the more important stations is reproduced herewith.

FIG. 3. Outline map of Province of Iyo, showing the more important stations of Ishihara and co-workers.

SUMMARY OF STATIONS IN SHIKOKU INCLUDED IN THE PRESENT REPORT

Station	Province	Altitudes (in meters)	Collector
Asizuri-misaki	Tosa	sea-level	Issiki-Ito
Ibuki (Mount)	Iyo	1,503	Ishihara et al.
Imanoyama (Mount)	Tosa	200 to 865	Issiki-Ito
Ishizuchi (Mount)	Iyo	1,400 to 1,980	Issiki-Ito, Ishihara et al.
Iwai	Tosa	100 to 200	Issiki-Ito
Iwaya (Mount)	Iyo	600	Ishihara et al.
Iwazeki, near Matsu-yama	Iyo		Ishihara et al.
Kajigamori (Mount)	Tosa	1,400	Ishihara et al.
Kawati (Tsurugi)	Awa	400	Issiki-Ito
Koguti (Ishizuchi)	Iyo	300	Issiki-Ito
Kokusen, near Yanase	Tosa	500	Issiki-Ito
Koti (Kochi)	Tosa		Issiki-Ito
Kyozyo (Tsurugi)	Awa		Issiki-Ito
Minokosi (Tsurugi)	Awa	1,400	Issiki-Ito
Misaka-toge (pass)	Iyo	716	Ishihara et al.
Muroto	Tosa		Issiki-Ito
Muroto-misaki	Tosa	sea-level	Issiki-Ito
Nagoro (Tsurugi)	Awa	900	Issiki-Ito
Nahari	Tosa		Issiki-Ito
Nisigawa, near Yanase	Tosa	700 to 1,000	Issiki-Ito
Odamachi-mura	Iyo		Ishihara et al.
Odamiyama	Iyo		Ishihara et al.
Ojoin, near Niihama	Iyo		Ishihara et al.
Omogokei (valley)	Iyo		Ishihara et al.
Otiai (Tsurugi)	Awa		Issiki-Ito
Saragamine (Mount)	Iyo	1,271	Ishihara et al.
Setokaze-toge (pass)	Iyo	212	Ishihara et al.
Simokawaguti	Tosa	sea-level	Issiki-Ito
Sugeoi (Tsurugi)	Awa		Issiki-Ito
Sugitate	Iyo		Ishihara et al.
Takanawa (Mount)	Iyo	986	Ishihara et al.
Totidane, near Yanase	Tosa	300 to 400	Issiki-Ito
Tsurugi (Turugi) Mount	Awa	1,400 to 1,955	Issiki-Ito
Yanase	Tosa	400	Issiki-Ito
Yuyama	Iyo		Ishihara et al.

My sincere thanks are due to Messrs. Esaki, Harukawa, Ishihara, Issiki, Ito, Miyatake, Mutuura, Yano, and others, who have made such an excellent start on the list of the Tipulidæ of Shikoku. From being the least known of the Japanese islands, this bids fair to becoming the best known and supporting one of the richest faunas.

RECORDS OF DISTRIBUTION

TIPULINÆ

1. LONGURIO (LONGURIO) PULVEROSA (Matsumura).

Togotipula pulverosa MATSUMURA, Thous. Ins. Japan Addit. 2 (1916) 464–465, *pl. 25, fig. 6* (whole ♀).

Longurio pulverosa ALEXANDER, Philip. Jour. Sci. 43 (1940) 382.

Longurio pulverosa ESAKI, et al., Icon. Insect, Japan. Ed. 2 (1950) 1513, *fig.*

Originally described from Kyoto, Honshu, collected by Nohira. Widespread in the major Japanese islands.

AWA: Kawati, altitude 400 meters, May 29, 1950 (*Issiki-Ito*).

IYO: Omogo, July 25, 1947 (*Takashi Kobayashi*).

TOSA: Asizuri-misaki, May 10, 1950 (*Issiki-Ito*); Iwai, Mount Imanoyama, altitude 200 meters, May 13, 1951 (*Issiki-Ito*).

Shikoku, without exact data, July 4, 1926 (*Issiki*).

2. LONGURIO (LONGURIO) YANOI sp. nov. **Plate 1, figs. 1, 3.**

General coloration of head and thorax orange, unpatterned; femora brownish yellow, clearer basally, the tips blackened; wings brownish yellow, the prearcular field and cell Sc yellow; stigma dark brown, very conspicuous; wing tip narrowly but conspicuously brown, extending from the stigma to beyond Cu; abdomen orange, the basal rings of the tergites slightly more pruinose; segments eight and nine black; male hypopygium with the beak of the inner dististyle relatively stout, spines of the style three or four in number.

Male.—Length, about 18 millimeters; wing, 17; antennæ, about 1.3.

Frontal prolongation of head yellow; palpi brown. Antennæ shorter than the palpi; scape and pedicel yellow, flagellum brown; first flagellar segment enlarged and partially united into a fusion-segment. Head orange.

Thorax uniformly orange, unpatterned. Halteres yellow. Legs with the coxæ and trochanters orange; femora brownish yellow, clearer basally, the tips blackened; tibiæ brown basally (remainder of all legs broken). Wings (Plate 1, fig. 1) brownish yellow, the prearcular field and cell Sc yellow, cell C more infuscated, especially on basal portions; stigma dark brown, very conspicuous; wing tip narrowly but conspicuously brown, extending from the stigma to beyond vein Cu, darkest and broadest at and near the apex; narrow to scarcely indicated dark seams over the cord and outer end of cell first M_2;

veins brown, Sc and the prearcular veins yellow. Venation: Rs arcuated, slightly longer than R_{2+3}; m-cu about one-sixth its length beyond the base of vein M_4.

Abdomen elongate, orange, the basal rings of the tergites slightly more pruinose; segments eight and nine, including the remainder of hypopygium black. Male hypopygium (Plate 1, fig. 3) with the beak of the inner dististyle, *d*, relatively stout; spines on face of style variable in number, in the unique type there being four spines on one side, three on the other.

Habitat.—Japan (Shikoku).

Holotype, male, Omogokei, Iyo, July 24, 1947 (*Kazuo Ishimaru*).

This interesting crane-fly is named for Mr. Yoshiro Yano, who has added several species of these flies to the Shikoku list. It is very different from the only other regional described member of the genus, *Longurio* (*Longurio*) *pulverosa* (Matsumura), especially in the coloration of the body and the very different male hypopygium. In its general appearance it is more like *L.* (*L.*) *fulvus* Edwards, of Formosa and eastern China, differing in the coloration of the body and wings, and in the details of structure of the male hypopygium.

3. CTENACROSCELIS MIKADO (Westwood).

Tipula mikado Westwood, Ent. Soc. London. Trans. (1876) 504.
Ctenacroscelis mikado Alexander, Philip. Jour. Sci. 43 (1940) 382.
Ctenacroscelis mikado Esaki, et al., Icon. Insect. Japon. Ed. 2 (1950) 1531, *fig.*

Iyo: Dogo, Matsuyama, July 30, 1948 (*Yano*); Mount Saragamine, altitude 1,271 meters, July 22, 1949 (*Ishihara*), August 17, 1950 (*Miyatake*); Mount Ishizuchi, altitude 800 meters, August 10, 1925 (*Harukawa*).

Tosa: Iwai, Mount Imanoyama, altitude 200 meters, May 13, 1951 (*Issiki-Ito*).

4. CTENOPHORA ISHIHARAI sp. nov.

Allied to *nohiræ;* flagellar branches of male shorter, the longest approximately two and one-half times as long as the segment; posterior tibia of both sexes slender and unmodified; male hypopygium on either side with a pencil of very long setæ, these hanging pendant.

Male.—Length, about 16 millimeters; wing, 14.5; antenna, about 7.

Female.—Length, about 22 millimeters; wing, 17.

Male.—Frontal prolongation of head, with the front, yellow; palpi black. Antennæ with the scape obscure yellow beneath,

the remainder brownish black to black; first flagellar segment produced into a triangular tooth beyond midlength of lower face; longest branch approximately two and one-half times the segment. Head above black, the genæ yellow.

Thorax black; dorsopleural membrane conspicuously yellow. Halteres obscure yellow, the knobs weakly more brownish yellow. Legs with the fore and middle coxæ yellow, narrowly lined with blackish on anterior face of basal half, posterior coxæ black; trochanters orange yellow; femora orange yellow, the tips broadly blackened, on the posterior legs including about the outer fourth; fore and middle tibiæ brownish yellow, the tips narrowly brownish black; tarsi black, the basitarsi more brightened at proximal end; posterior tibiæ yellow basally and on posterior half, alternating with black rings before midlength and at apex, the latter narrowest; no modified swollen area on posterior tibia of male, the condition being essentially as in the female. Wings with the base and stigmal region light yellow, the remainder of ground color grayish, including the posterior border and apex; a very broad blackened band before the cord and a smaller area at and beyond this, extending posteriorly to include the outer half of cell 1st M_2 and the bases of cells M_1 and 2nd M_2, the two darkened areas separated by a narrow pale yellow band at and before the cord, this being a posterior continuation of the more brightly colored stigma; veins brown, more yellowed in the brightened fields. Venation: Rs long, subequal to the distal section of R_{4+5}; cell M_1 broadly sessile.

Abdomen with the first tergite black, with a yellow spot on either side at base; second tergite chiefly yellow, its apical fourth black; segments three and four black, fifth and sixth chiefly orange; outer segments, including the hypopygium, black; sternites with the second segment yellow, the third and base of fourth black; remainder of fourth and all of fifth and sixth orange, the remainder black. Male hypopygium large and massive, with a pencil of very long setæ on either side, hanging pendant, this apparently lacking in *nohiræ*. Due to the condition of the unique type male I do not consider it advisable to dissect and mount the hypopygium for more detailed study.

Female.—Generally as in the male, differing in the sexual characters and in details of coloration. Frontal prolongation of head blackened, the remainder of head chiefly black, the pale color reduced. Antennæ black throughout; flagellar segments

simple, their lower faces slightly to scarcely produced. Abdomen with fourth and fifth segments broadly blackened basally, their outer ends orange. Ovipositor with the basal shield black; cerci relatively short and straight, dark reddish horn color.

Habitat.—Japan (Shikoku).

Holotype, male, Mount Ishizuchi, Iyo, July 26, 1947 (*Miyatake*). Allotopotype, female, July 25, 1947 (*Ishihara*).

I take unusual pleasure in naming this distinct fly for Professor Tamotsu Ishihara, authority on the Hemiptera of Japan and Formosa. The species is closest to *Ctenophora nohiræ* Matsumura, being quite distinct in the unmodified posterior tibiæ of the male and in other characters diagnosed above. The genus *Cnemoncosis* Enderlein [13] was proposed for the supposed new species, *C. hilgendorfi* Enderlein, from an unknown locality in Japan. The genus was differentiated from *Pselliophora* solely by the presence of a large swelling or enlargement on the basal half of the posterior tibia of the male. In the light of the discovery of the present fly it seems obvious that there is no sufficient basis for separating the genus from *Ctenophora* Meigen or maintaining the species *hilgendorfi* as distinct from the earlier *nohiræ* Matsumura. As regards the use of strictly sexual characters for the differentiation of genera and subgenera in this group of Tipulidæ, attention should be called to *Ctenophora tricolor* Loew, of eastern Siberia, which shows an even more striking enlargement of the posterior femur in the male yet for which no generic or subgeneric term has ever been deemed necessary.

5. DICTENIDIA PICTIPENNIS FASCIATA Coquillett.

Dictenidia fasciata COQUILLETT, U.S. Nat. Mus. Proc. 21 (1898) 304.

Ctenophora pictipennis PORTSCHINSKY, Horae Soc. Entomol. Ross. 21 (1887) 3, *pl. 1, fig. 1* (typical form of species).

Dictenidia pictipennis fasciata ALEXANDER, Philip. Jour. Sci. 60 (1936) 170.

Dictenidia fasciata ESAKI, et al., Icon. Insect. Japon. Ed. 2 (1950) 1530, *fig.; pl. 15, fig. iii* (color).

AWA: Kyozyo, June 6, 1950 (*Issiki-Ito*); Otiai, June 5, 1950 (*Issiki-Ito*); Nagoro to Sugeoi, June 3, 1950 (*Issiki-Ito*); Sugeoi, June 4, 1950 (*Issiki-Ito*).

IYO: Matsuyama, April 19, 1949 (*Miyatake*); Mount Saragamine, altitude 1,271 meters, May 23, 1950 (*Miyatake*).

TOSA: Mount Kajigamori, altitude 1,400 meters, May 20, 1951 (*Miyatake*).

[13] Enderlein, Günther. Zool. Anzeiger 52 (1921) 219–232.

6. DICTENIDIA MIYATAKEI sp. nov. **Plate 1, fig. 2.**

General coloration of head and thorax black; abdomen black, with segments two to four inclusive chiefly orange; femora yellow, the tips blackened, on the posterior legs including about the outer fourth; tibia with about the central half yellow, the base narrowly, the apex more broadly blackened; wings with the restricted prearcular field yellow, followed by a very broad blackened band that extends distad to the level of the stigma or shortly beyond the cord, the outer end of the wing hyaline with a scarcely indicated darkening in extreme outer ends of cells R_3 to M_1, inclusive; no macrotrichia in outer wing cells; cell M_1 nearly twice its petiole.

Male.—Length, about 13 millimeters; wing, 12; antenna, about 5.

Frontal prolongation of head black, nasus stout; palpi with basal segments pale, the terminal one abruptly blackened. Antennæ black, the apices of the proximal seven or eight flagellar segments narrowly yellow, the branches black; branches relatively long and conspicuous, the longest nearly three times the segment; branches not greatly unequal, the outer one being about seven-eighths the basal one and more slender. Head black.

Thorax black, the surface polished. Halteres blackened. Legs with the coxæ black, sparsely dusted with brown pollen; trochanters dark, obscure brownish yellow at tips; femora yellow, the tips blackened, on the posterior legs including about the outer fourth; tibia with about the central half yellow, the base narrowly, the apex more broadly blackened; tarsi black. Wings (Plate 1, fig. 2) with the restricted prearcular field, including the veins, yellow, followed by a very broad blackened band that extends distad to the level of the stigma or shortly beyond the cord; certain of the cells with pale central streaks; wing beyond the darkened band hyaline, involving nearly the outer third of wing, with a very narrow darkening in extreme outer ends of cells R_3 to M_1, inclusive; stigma oval, slightly darker than the blackened band; veins dark brown. No macrotrichia in outer wing cells. Venation: R_5 very long, exceeding R_3; cell M_1 nearly twice its petiole.

Abdomen with the basal segment black, narrowly pale basally; tergite two orange yellow, the apex darkened; tergite three similar, the darkened band subapical, the extreme apex yellowed; tergite four brownish orange, the apex narrowly yellow;

sternites two and three obscure orange; fifth and succeeding segments, including the hypopygium, black.

Habitat.—Japan (Shikoku).

Holotype, male, Mount Ishizuchi, Iyo, July 28, 1951 (*Miyatake*).

This distinct species is named for Professor Mutsuo Miyatake who has added materially to our knowledge of the Tipulidæ of Shikoku. The fly is quite distinct from the only species known from the main islands of Japan, *Dictenidia pictipennis* Portschinsky, and its subspecies *fasciata* Coquillett, differing in the pattern of the body, legs and wings, and in the lack of macrotrichia in the outer wing cells. In this latter regard it is closer to the extralimital *D. glabrata* Alexander and *D. inæquipectinata* Alexander, which are quite different in coloration and in details of structure.

7. **TANYPTERA JOZANA JOZANA (Matsumura).**

Xiphusa jozana MATSUMURA, Thous. Ins. Japan Addit. 2 (1916) 450–451, *pl. 24, fig. 13* (whole ♀).

Tanyptera jozana ALEXANDER, Philip. Jour. Sci. 60 (1936) 174.

Mesodictenidia macræformis MATSUMURA, 6,000 Illus. Ins. Japan Empire (1931) 395, *fig.* (whole ♂).

Tanyptera jozana ESAKI, et al., Icon. Insect. Japon. Ed. 2 (1950) 1530, *fig.*

AWA: Mount Tsurugi, Kawati to Minokosi, 1,400 meters, May 30, 1950 (*Issiki-Ito*).

In the second Matsumura reference above cited, the supposed new genus and species, *Mesodictenidia macræformis* was proposed. I am greatly indebted to Doctor Kuwayama for translating this description from the Japanese and for making an examination of the type specimen, preserved in Sapporo. This translation is as follows:

"Seguro-kushihige-gaganbo—(257). Body polished black; maxillary palpi and antennae yellow, excepting the basal part of the latter which is blackish. Anterior margin and lateral stripes of notum and the lateral borders of the scutellum yellow. Wings hyaline, faintly tinged with yellow. Abdomen and halteres yellow, the dorsal stripe of the former being dark brown. Legs yellow, the half of the apical part of the hind tibia light colored. Length circa 17 millimeters. Common in the vicinity of Sapporo.

Distribution—Hokkaido."

Under date of June 20, 1939, Dr. Kuwayama supplied me with a very carefully executed figure of about the fifth flagellar segment of the antenna of the type, this showing a perfectly normal *Tanyptera*, evidently of the present species.

7a. TANYPTRA JOZANA FUMIBASIS Alexander.

Tanyptera jozana fumibasis ALEXANDER, Ann. and Mag. Nat. Hist. (9) 15 (1925) 392.

IYO: Mount Takanawa, April 29, 1948 (*Takashi Kobayashi*); Yuyama, May 9, 1948 (*Miyatake*).

8. TIPULA (NIPPOTIPULA) COQUILLETTI Enderlein.

Tipula nubifera COQUILLETT, U. S. Nat. Mus. Proc. 21 (1898) 305–306.

Tipula coquilletti ENDERLEIN, Zool. Jahrb., Syst. 32 (1912) 7.

Nippotipula nubifera MATSUMURA, Thous. Ins. Japan Addit. 2 (1916) 457–458, *pl. 25, fig. 1* (whole ♀).

Tipula (Nippotipula) coquilletti ALEXANDER, Philip. Jour. Sci. 57 (1935) 92.

Tipula coquilletti ESAKI, et al., Icon. Insect. Japon. Ed. 2 (1950) 1537, *fig.*

IYO: Kuma, May 22, 1949 (*Takashi Kobayashi*); Matsuyama, April 21, 1951 (*Miyatake*), October 11, 1948, at light trap (*Ishihara-Miyatake*); Odamachi-mura, Kamiukeana-gun, May 1, 1945 (*Akio Yatsuzuka*); Sugitate, May 24, 1947 (*Miyatake*).

TOSA: Nisigawa, near Yanase, altitude 700 to 1,000 meters, May 3, 1951 (*Issiki-Ito*).

9. TIPULA (TRICHOTIPULA) POLITONIGRA sp. nov. **Plate 1, fig. 4.**

General coloration of head and thoracic pleura gray, the præscutum and scutal lobes polished black; antennæ black throughout; wings weakly brownish yellow, stigma dark brown; abundant macrotrichia in cells beyond cord; vein R_{1+2} atrophied; basal abdominal sternites more or less yellowed, the outer segments blackened; male hypopygium with the gonapophysis appearing as a broadly flattened dark-colored blade, its stem very short.

Male.—Length, about 9.5 to 10 millimeters; wing, 11.5 to 12; antenna, about 4 to 4.5.

Frontal prolongation of head gray; nasus elongate; palpi black. Antennæ (male) of moderate length, approximately one-third as long as wing, black throughout; flagellar segments very vaguely to scarcely incised, subcylindrical, considerably longer than their verticils. Head light gray, with a very poorly indicated capillary darker median line; no vertical tubercle; anterior vertex very broad, approximately five times the diameter of scape.

Pronotum obscure yellow medially, dark gray in front and on sides. Mesonotal præscutum and scutal lobes entirely polished black, the median region of scutum restrictedly obscure yellow; scutellum somewhat less intensely black, para-

scutella brownish black; postnotum and pleura gray pruinose; dorsopleural membrane light yellow. Halteres yellow, the knobs more saturated yellow. Legs with the coxæ light gray pruinose; trochanters yellow; femora yellow, the tips broadly black, including about the outer fourth of the fore pair, and outer fifth of posterior femora; tibiæ and tarsi black; claws (male) simple. Wings weaky tinged with brownish yellow, the prearcular field and cell Sc clearer yellow, cell C a trifle darker; a vague and narrow darkening around the apical wing margin; stigma oval, dark brown; a restricted brown seam on outer side of anterior cord in cells R_3 and R_5; veins and macrotrichia dark brown, the prearcular veins and Sc yellowed. Abundant macrotrichia in cells beyond cord and in the outer ends of cells R, Cu, first A and second A, the other cells of basal half of wing glabrous. Venation: Sc_2 ending about opposite three-fourths the length of Rs; R_{1+3} atrophied; petiole of cell M_1 about three times m; m-cu oblique, subequal in length to or a trifle shorter than Rs.

First abdominal segment dark brown, the second tergite chiefly yellow, darkened medially on posterior ring; tergites three to five dark brown, the lateral borders broadly, the posterior margins narrowly yellow; outer segments more extensively blackened, with narrow yellow margins; basal sternites yellow, the outer segments brownish black, four to seven, inclusive, with narrow yellow posterior borders; hypopygium black. Male hypopygium (Plate 1, fig. 4) with the ninth tergite, *9t*, transverse, produced into two very low black lobes, the surface of which is microscopically roughened; lobes separated by a very small U-shaped notch. Outer dististyle, *d*, appearing as a slender clavate blade. Inner dististyle small and compact, the beak blunt, heavily blackened, the lower beak lacking; across face of style with a serrated blackened flange; base of style with an obtuse flattened lobe or blade. Ædeagus, *a*, small and simple, yellow, the apex narrowed to a slender point. Gonapophysis, *g*, appearing as a very broadly flattened dark-colored blade, subcircular in outline, its greatest width being nearly equal to the length, the stem very short.

Habitat.—Japan (Honshu, Shikoku).

Holotype, male, Mount Tsurugi, Awa, Shikoku, altitude 1,400 to 1,955 meters, May 31, 1950 (*Issiki-Ito*). Paratopotype, male. Paratypes, ♂, Nisigawa to Yanase, Tosa, Shikoku, altitude 600 meters, May 4, 1951 (*Issiki-Ito*); ♂, Kuroyu, Akita, Honshu, altitude 850 meters, June 14, 1951 (*Issiki-Ito*).

Tipula (*Trichotipula*) *politonigra* is the first species of the subgenus to be found in the main islands of Japan. It is entirely different in coloration and structure from the various species known from Formosa and China, including *T.* (*T.*) *haplotricha* Alexander, *T.* (*T.*) *longifimbriata* Alexander, *T.* (*T.*) *mallophora* Alexander, and *T.* (*T.*) *polytricha* Alexander, the intensely blackened and polished thoracic dorsum being particularly conspicuous and distinctive.

10. TIPULA (SCHUMMELIA) JOCOSIPENNIS Alexander.

Tipula jocosipennis ALEXANDER, Philip. Jour. Sci. **51** (1933) 374–376, *pl. 1, fig. 4* (venation), *pl. 2, fig. 28* (♂ hypopygium).

Tipula (*Schummelia*) *jocosipennis* ALEXANDER, Philip. Jour. Sci. **57** (1935) 102.

IYO: Koguti to Mount Ishizuchi, altitude 1,400 meters, June 8, 1950 (*Issiki-Ito*); Mount Ishizuchi, altitude 1,400 to 1,980 meters, June 9 to 10, 1950 (*Issiki-Ito*).

11. TIPULA (SCHUMMELIA) MACROTRICHIATA Alexander.

Tipula macrotrichiata ALEXANDER, Ent. Soc. America Ann. **17** (1924) 443–444.

Tipula (*Schummelia*) *macrotrichiata* ALEXANDER, Philip. Jour. Sci. **57** (1935) 102.

IYO: Koguti to Mount Ishizuchi, altitude 1,400 meters, June 8, 1950 (*Issiki-Ito*).

12. TIPULA (YAMATOTIPULA) TSURUGIANA sp. nov. **Plate 1, fig. 6.**

Belongs to the *iroquois* group; general coloration of head and thorax light gray, the præscutum with three slightly darker stripes that are narrowly bordered by brown; nasus lacking; antennæ black, pedicel obscure brownish yellow; halteres yellow; legs black, with about the proximal half of the femora yellowed; wings subhyaline, restrictedly patterned with brown, including the tips; basal abdominal tergites chiefly yellow, the third and succeeding ones dark brown with broad yellow lateral borders; male hypopygium black; tergite at apex produced into two slightly decurved blades; outer dististyle elongate; gonapophysis short-stemmed, the darkened apical blade subcircular in outline.

Male.—Length, about 13 millimeters; wing, 14; antenna, about 5.

Frontal prolongation of head elongate, sloping gradually to the vertex, black, heavily pruinose basally, less so at the apex; nasus lacking; palpi black. Antennæ moderately long; scape black, sparsely pruinose, pedicel obscure brownish yellow, flagellum black; flagellar segments very vaguely incised, the basal enlargement being scarcely indicated; verticils shorter

than the segments. Head gray, lighter on the orbits; vertical tubercle scarcely developed.

Pronotum gray. Mesonotum light gray, the præscutum with three slightly darker gray stripes that are narrowly bordered by brown, the latter obsolete or virtually so on anterior third of median stripe; very vague indications of a dark dividing line on central stripe, this obsolete in front; pseudosutural foveæ very small, comma-shaped, black; scutal lobes with similar darker brownish gray centers. Pleura and pleurotergite clear light gray; dorsopleural membrane yellow. Halteres yellow. Legs with all coxæ light gray; trochanters yellow; femora yellow basally, with about the outer half brownish black; tibiæ and tarsi brownish black to black; claws (male) with small basal tooth. Wings subhyaline, the prearcular and costal fields light yellow, especially the former; stigma oval, dark brown; wing tip narrowly but distinctly dark brown; vague dark clouds over the anterior cord and along more than the outer half of vein Cu; veins dark brown, yellow in the flavous portions. Veins beyond cord with abundant trichia; about three scattered trichia in distal end of cell R_5. Venation: A faint spur of vein Sc_1 far before end of Sc_2; Rs about twice m-cu; R_{1+2} preserved; petiole of cell M_1 more than one-half longer than m; m-cu relatively long, at fork of M_{3+4}.

First abdominal tergite gray, yellow laterally; second tergite chiefly yellow, darker subterminally, the lateral borders broadly yellow; third and succeeding tergites dark brown, the lateral borders broadly yellow, the posterior margins very narrowly so; basal sternites pale yellow; outer segments, including hypopygium, black. Male hypopygium (Plate 1, fig. 6) with the suture between the tergite and sternite complete; basistyle and sternite fused the apex of the former extended caudad beyond the level of the tergite or sternite, with the dististyles at apex. Ventral region of ninth sternite, *9s*, extensive, separated from the basistyle by a distinct notch, its lower angle produced ventrad into a low lobe that is provided with short black setæ. Ninth tergite, *9t*, black, extensive, the apex rounded, its central portion produced into an obscure yellow lobe that divides into two deep, slightly decurved points or blades. Outer dististyle, *d*, unusually long and slender, gradually narrowed to the obtuse tip. Inner dististyle, *d*, subquadrate in its general outline, the beak short and stout; outer margin of style a conspicuously blackened blade; face of style bearing a strong acute spine. Gonapophysis, *g*, short-stemmed, the dark colored

blades subcircular or short-oval in outline. Eighth sternite unarmed.

Habitat.—Japan (Shikoku).

Holotype, male, Mount Tsurugi, Awa, altitude 1,400 to 1,955 meters, May 31, 1950 (*Issiki-Ito*).

The closest described relative is *Tipula* (*Yamatotipula*) *sempiterna* Alexander, of the Japanese Alps, Honshu, which is quite distinct in the structure of the male hypopygium, particularly the ninth tergite, both dististyles, and the blade of the gonapophysis. Even closer is the fly next described as *T.* (*Y.*) *misakana* sp. nov., which is compared with this species at that point. As has been indicated earlier, the flies of the present group seem to be most nearly allied to a small aggregation of forms in eastern North America that center about *T.* (*Y.*) *iroquois* Alexander, including about half a dozen species, most of which are restricted to the southern Appalachian mountains, as *T.* (*Y.*) *brevifurcata* Alexander, *T.* (*Y.*) *catawbiana* Alexander, and *T.* (*Y.*) *nephophila* Alexander. It seems probable that these included forms were more wide-spread in past ages and that their present concentration in the southeastern United States results from the action of glaciers during the recent Wisconsin Ice Age. All members of the group live close to small mountain streams and, where known, have an aquatic larva. The Japanese members of the *iroquois* group may have similar habits and habitats.

13. TIPULA (YAMATOTIPULA) MISABANA sp. nov. Plate 1, fig. 7.

Belongs to the *iroquois* group, allied to *tsurugiana;* general coloration gray, the præscutum with four scarcely differentiated darker stripes that are separated by narrow darker lines; antennæ black, the pedicel reddish brown; nasus lacking; legs black, the femoral bases extensively brown, including about the proximal third on the fore femora, more extensive on the other legs; wings weakly tinged with brown, patterned with darker, including the apex; basal abdominal segments light brown, darker posteriorly; outer segments, including the hypopygium, black; male hypopygium with the tergite produced into two slightly divergent blades, without teeth; ninth sternite at base of median notch with a pair of rounded hairy lobes; outer dististyle long and narrow; inner dististyle with the beak elongate, the outer basal lobe developed into a powerful outwardly-directed lobe that terminates in a stout blackened spinous point; blade of gonapophysis darkened.

Male.—Length, about 14 millimeters; wing, 15.5; antenna, about 5.8.

Frontal prolongation of head elongate, without nasus, approximately equal to the remainder of head, light gray; prolongation merging gradually with the remainder of front without a marked angle; palpi dark brown. Antennæ (male) relatively long, black, scape sparsely pruinose; pedicel reddish brown; flagellar segments weakly incised, the intermediate ones longer than the verticils. Head gray; anterior vertex broad, without a distinct tubercle.

Pronotum light gray. Mesonotum gray, the præscutum with three narrow darker lines representing interspaces between four scarcely differentiated stripes; centers of scutal lobes weakly darkened, vaguely ringed with darker. Pleura clear light gray, the restricted dorsopleural membrane and pretergites more yellowed. Halteres with stem brownish yellow, knob more infuscated. Legs with all coxæ light gray; trochanters yellow; femora brown, passing into black, the latter color more extensive on the fore legs where about the outer two-thirds are included, narrower on the other legs, on the middle femora including about the outer half, the posterior femora the outer two-fifths; tibiæ and tarsi black; claws (male) small, with a reduced basal spine. Wings with a weak brownish ground, the prearcular and costal fields strongly yellowed; stigma oval, dark brown; a conspicuous paler brown pattern, including especially the wing tip, as far basad as the fork of M_{1+2}; narrower seams over the cord and along vein Cu except at base, this pattern in cells M and M_4; veins brown, yellow in the brightened fields. Venation: Rs somewhat longer than in tsurugiana.

Abdomen with the basal tergite brownish gray, margined laterally with obscure yellow; tergites two and three light brown, their posterior ends darker brown, the apices narrowly pale; outer segments gradually deepening to black, including the hypopygium. Male hypopygium (Plate 1, fig. 7) with the ninth tergite, *9t*, broad, its posterior border narrowed, directed caudad and ventrad, terminating in two small blades that are extended laterad into acute points, the blades separated by a U-shaped notch; surface of tergite with numerous setæ, smaller on the blades, with no denticles or serrations. Ninth sternite at base of notch with a pair of conspicuous rounded black lobes, rather closely approximated, directed ventrad and caudad, clothed with coarse black setæ. Outer dististyle, *d*, long and narrow, tapering gradually to the obtuse tip. Inner dististyle,

d, with the beak elongate, obtuse at tip, the dorsal crest low, smooth; the usual outer basal lobe very conspicuous, appearing as a stout lobe that is directed outward, narrowed at apex into a stout blackened spinous point; sensory area on disk of style, including only seven or eight areoles; surface of disk of style with abundant pale setæ. Gonapophysis, *g*, appearing as a dark-colored blade, the stem more slender, slightly exceeding the simple ædeagus.

Habitat.—Japan (Shikoku).

Holotype, male, Misaka-toge (Misaka Pass), Iyo, altitude 716 meters, May 3, 1951 (*Toshiro Yano*).

The nearest ally of the present fly is *Tipula* (*Yamatotipula*) *tsurugiana* sp. nov., which differs evidently in the structure of the male hypopygium, particularly the inner dististyle. The notes supplied under the preceding species should be consulted.

14. TIPULA (YAMATOTIPULA) PATAGIATA Alexander.

Tipula patagiata ALEXANDER, Ann. and Mag. Nat. Hist. (9) 14 (1924) 465–466.

Tipula (*Yamatotipula*) *patagiata* ALEXANDER, Philip. Jour. Sci. 57 (1935) 108.

IYO: Misaka-toge, altitude 716 meters, May 3, 1951 (*Yano*).

15. TIPULA (INDOTIPULA) YAMATA Alexander.

Tipula yamata ALEXANDER, Can. Ent. 46 (1914) 208–209, *pl. 16, fig. 5* (wing), *pl. 17, fig. 3* (♂ hypopygium).

Tipula (*Indotipula*) *yamata* ALEXANDER, Philip. Jour. Sci. 57 (1935) 113.

Tipula yamata ESAKI, et al., Icon. Insect. Japon. Ed. 2 (1950) 1534, *fig.*

AWA: Kawati, altitude 400 meters, May 29, 1950 (*Issiki-Ito*).

TOSA: Asizuri-misaki sea-level, May 10, 1951 (*Issiki-Ito*).

16. TIPULA (VESTIPLEX) SERRIDENS Alexander.

Tipula serridens ALEXANDER, Amer. Ent. Soc. Trans. 46 (1920) 18–19.

Tipula (*Vestiplex*) *serridens* ALEXANDER, Philip. Jour. Sci. 57 (1935) 118.

AWA: Mount Tsurugi, altitude 1,400 to 1,955 meters. May 31, 1950 (*Issiki-Ito*).

17. TIPULA (ACUTIPULA) TOKIONIS Alexander.

Tipula tokionis ALEXANDER, Insec. Inscit. Menst. 8 (1920) 138.

Tipula (*Acutipula*) *tokionis* ALEXANDER, Philip. Jour. Sci. 57 (1935) 109.

AWA: Mount Tsurugi, Kawati to Minokosi, altitude 1,400 meters, May 30, 1950 (*Issiki-Ito*).

IYO: Mount Saragamine, altitude 1,271 meters, August 17, 1950 (*Miyatake*); Mount Ishizuchi, altitude 1,000 meters, August 10, 1925 (*Harukawa*).

TOSA: Mount Imanoyama, Iwai, altitude 200 meters, May 11, 1951 (*Issiki-Ito*).

18. TIPULA (OREOMYZA) DICHROISTIGMA Alexander.

Tipula dichroistigma ALEXANDER, Amer. Ent. Soc. Trans. 46 (1920) 20–21.

Tipula (*Oreomyza*) *dichroistigma* ALEXANDER, Philip. Jour. Sci. 57 (1935) 122.

AWA: Mount Tsurugi, Kawati to Minokosi, altitude 1,400 meters, May 30, 1950 (*Issiki-Ito*).

IYO: Mount Ishizuchi, altitude 1,400 meters, June 9, 1950 (*Issiki-Ito*).

19. TIPULA OREOMYZA FUTILIS Alexander.

Tipula futilis ALEXANDER, Ann. and Mag. Nat. Hist. (9) 14 (1924) 459–460.

Tipula (*Oreomyza*) *futilis* ALEXANDER, Philip. Jour. Sci. 57 (1935) 122.

AWA: Mount Tsurugi, Kawati to Minokosi, altitude 1,400 meters, May 30, 1950 (*Issiki-Ito*).

20. TIPULA (OREOMYZA) IMITATOR sp. nov. **Plate 1, fig. 5.**

Size medium (wing, male, about 15 millimeters); general coloration of head and thorax gray; præscutum with three very poorly indicated darker gray stripes; antennæ black, the scape and pedicel yellow, the former restrictedly darkened at base; femora yellow basally, the tips broadly blackened, tibiæ and tarsi black; wings whitened, the prearcular and costal fields more yellowed; stigma dark brown; disk with extensive pale brown clouds, the wing tip solidly darkened; basal abdominal segments yellow, the tergites with a continuous black central line, the outer segments uniformly blackened; male hypopygium with the tergite large, deeply notched posteriorly, with a very small tooth at the base of the notch; inner dististyle with the lower beak conspicuously bilobed; gonapophysis appearing as a flattened yellow blade, at apex narrowed into a small curved hook.

Male.—Length, about 14 millimeters; wing, 15.5; antenna, about 4.1.

Frontal prolongation of head relatively short and stout, dark brown, pruinose, especially above; nasus long and slender; palpi dark brown. Antennæ (male) of moderate length, as

shown by the measurements; scape yellow, restrictedly darkened at base, pedicel light yellow, flagellum black, the first segment brownish yellow, narrowly darkened apically; flagellar segments beyond the first only feebly incised, much longer than the verticils. Head gray, somewhat clearer on the orbits; a barely indicated capillary dark vitta, extending backward from the low vertical tubercle.

Pronotum dark gray, pale gray on the sides. Mesonotum light gray, the præscutum with three very poorly indicated darker gray stripes, the central one divided behind; each scutal lobe with two poorly indicated darker areas; posterior sclerites of notum gray, parascutella more yellowed; pleurotergite gray, the katapleurotergite paler; dorsopleural membrane pale yellow. Halteres with stem obscure yellow, knob weakly infuscated. Legs with the coxæ light gray; trochanters yellow; femora yellow basally, the tips broadly blackened, the amount subequal on all legs, the fore pair slightly obscured over the central portion; tibiæ and tarsi black; claws (male) toothed. Wings with the ground color whitened, the prearcular and costal fields more yellowed; stigma dark brown; wing tip solidly medium brown, extending as far basad as the outer end of cell 1st M_2; basad of cord with extensive very pale brown clouds, most evident in the outer ends of cells R and M and in the outer half of cell 1st A; restricted slightly darker areas at origin of Rs and over the anterior cord; of the white ground areas, the only one beyond the cord is a complete band that is slightly narrowed at both ends, occupying virtually all of cell 1st M_2; veins brown, yellow in the flavous areas. Venation: Rs about two and one-half times m-cu; R_{1+2}; preserved; m and petiole of cell M_1 subequal.

Abdomen with the basal three or four tergites yellow, with a continuous black central line, the sublateral portions less evidently darkened, posterior borders very narrowly yellow; first tergite sparsely pruinose; basal four sternites yellow; outer segments brownish black. Male hypopygium (Plate 1, fig 5) with the ninth tergite, *9t*, large, gradually narrowed outwardly, the posterior border with two broadly obtuse flattened lobes that are separated by a narrower notch, at base of latter with a microscopic tooth; outer third of tergite obscure yellow, the remainder darkened. Outer dististyle, *d*, relatively long, its lower margin sinuous. Inner dististyle, *d*, with the beak relatively slender, with a strong carina extending from the up-

per part back across the disk of the style; lower beak blackened, conspicuously bilobed; posterior crest a flattened blade that is extended outwardly into a weak point; upper margin of style above the beak with oblique parallel lines or ribs. Gonapophysis, *g*, chitin yellow, appearing as a flattened blade, at apex narrowed into a small curved hook. Aedeagus slender.

Habitat.—Japan (Shikoku).

Holotype, male, Mount Tsurugi, Awa, altitude 1,400 to 1,955 meters, May 31, 1950 (*Issiki-Ito*).

The most similar described regional species include *Tipula* (*Oreomyza*) *pollex* Alexander and *T.* (*O.*) *matsumuriana* Alexander, which differ in the details of coloration and, especially, in the structure of the male hypopygium.

21. TIPULA (OREOMYZA) SETICELLULA Alexander.

Tipula seticellula ALEXANDER, Philip. Jour. Sci. 49 (1932) 106–108, *pl. 1, fig. 2* (venation), *pl. 2, figs. 24–28* (♂ hypopygium).

Tipula (*Oreomyza*) *seticellula* ALEXANDER, Philip. Jour. Sci. 57 (1935) 122.

AWA: Mount Tsurugi, Otiai, June 5, 1950 (*Issiki-Ito*).

The macrotrichia of the wing cells are more reduced in number than in the types, most evident in the distal end of cell R_3.

22. TIPULA (LUNATIPULA) PENDULA Alexander.

Tipula pendula ALEXANDER, Ann. and Mag. Nat. Hist. (9) 14 (1924) 469.

Tipula (*Lunatipula*) *pendula* ALEXANDER, Philip. Jour. Sci. 57 (1935) 131.

AWA: Mount Tsurugi, Kawati to Minokosi, altitude 1,400 meters, May 30, 1950 (*Issiki-Ito*).

23. TIPULA (LUNATIPULA) NAVICULIFER BREVISCAPHA subsp. nov. Plate 2, fig. 9.

Close to the typical form, differing especially in details of structure of the male hypopygium, particularly the ninth tergite and the eighth sternite.

Male.—Length, about 20 millimeters; wing, 22; antenna, about 3.9.

Female.—Length, about 23 millimeters; wing, 27; antenna, about 4.

Frontal prolongation of head brownish black, heavily pruinose; nasus distinct, clothed with golden yellow setæ; palpi black, the outer end of the terminal segment paler. Antennæ with scape and pedicel yellow, flagellum black, the incisures of the more proximal segments restrictedly pale; flagellar segments only moderately enlarged at base, shorter than the lon-

gest verticils. Head behind gray, whitened on the low vertical tubercle and surrounding the antennal bases; posterior vertex with a very delicate blackened median line.

Pronotal scutum gray, more infuscated medially; scutellum chestnut, gray on sides.—Mesonotal præscutum with the ground grayish yellow, with four stripes, the intermediate pair brownish gray, clearer gray on anterior ends, the lateral borders broadly and conspicuously blackened; a capillary pale median vitta; lateral stripes dark gray, their inner margin blackened; posterior sclerites of notum light gray, each scutal lobe with two brown areas; an interrupted brownish black central line on the scutellum and mediotergite; pleurotergite gray, the elevated part of the katapleurotergite yellow. Pleura light gray; dorsopleural membrane light yellow. Halteres with stem yellow, base of knob darkened. Legs with the coxæ light gray; trochanters yellow; femora yellow to brownish yellow basally, passing into yellowish brown, the tips blackened; tibiæ and tarsi black; claws (male) small, simple. Wings pale yellow, with a moderately conspicuous brown pattern that includes washes in the outer radial field, the extreme wing tip and as zigzag areas basad of the cord, the most conspicuous crossing the wing from the origin of Rs, widely expanded in the outer ends of the anal cells; restricted darker brown areas at origin of Rs and along the cord; stigma with the center yellow, the margins brown; prearcular and costal fields deeper yellow than remainder of ground; veins brownish black, more yellowed in the costal and stigmal regions, especially in female. The wing of the female is broader than that of the male, the latter still narrower than in the corresponding sex of typical *naviculifer*. Venation: Rs very long, exceeding two and one-half times m-cu; m subequal to or longer than the petiole of cell M_1.

Abdomen with basal tergite gray pruinose; succeeding tergites yellow, with a brown central stripe; basal sternites yellow; outer segments gradually more darkened, the outer ones chiefly black. In the female, the tergites with three conspicuous blackened stripes, interrupted at the incisures, the lateral borders broadly yellow; sternites likewise patterned with dark brown; pleural membrane yellow, with a continuous dark brown longitudinal stripe; outer segments more uniformly darkened, pruinose. Ovipositor (Plate 1, fig. 10) reduced, fulvous; cerci fleshy, decurved; hypovalvæ, as viewed from the

sides, broadly triangular in outline, the tips obtuse. The related species *shogun* is shown for comparison (Plate 1, fig. 11). Male hypopygium (Plate 1, fig. 9) with the ninth tergite, *9t*, narrowly transverse, the lobes of the posterior border small, directed mesad, provided with short dense black setæ; notch between the lobes broad and shallow. Outer dististyle, *d*, a stout clavate lobe, the apex short and blunt. Inner dististyle, *d*, terminating in a slender blackened beak, with a subapical black blade additional to a slender black spine on face of disk. Appendage of eighth sternite, *8s*, shorter than in typical *naviculifer* especially the yellowed apical portion. In the typical subspecies, *naviculifer* (Plate 1, fig. 8), the ninth tergite, *9t*, is relatively longer, the posterior border with two conspicuous lobes that are separated by a narrow diamond-shaped notch; lobes with very numerous dense black setæ. Outer dististyle, *d*, with the lobe strongly produced laterad into a beak, the actual tip pointed. Inner dististyle, *d*, much as in *breviscapha*, apparently without a subapical blackened blade, as described above. Appendage of eighth sternite, *8s*, elongate, boat-shaped, when flattened on a microscope slide showing the pale whitened part nearly equal in length to the darkened central portion of the ligula.

Habitat.—Japan (Shikoku).

Holotype, male, Mount Tsurugi, Awa, Nagoro, altitude 900 meters, June 2, 1950 (*Issiki-Ito*). Allotopotype, female; in copulation with the type.

Tipula (*Lunatipula*) *shogun* Alexander, of Hokkaido, compared above, is evidently closely allied to the present fly, differing in details of coloration, including the præscutal stripes and the lack of a dark median vitta on the posterior sclerites of the notum. The male sex is still not known to me.

CYLINDROTOMINÆ

24. LIOGMA SERRATICORNIS Alexander.

Liogma serraticornis ALEXANDER, Ent. Soc. America Ann. 12 (1919) 345-346.

Liogma fuscipennis ALEXANDER, Philip. Jour. Sci. 49 (1932) 111–112, *pl. 1, fig. 5* (venation), *pl. 2, fig. 32* (antenna ♂).

Liogma serraticornis ESAKI, et al., Icon. Insect. Japon. Ed. 2 (1950) 1514, *fig.*

AWA: Mount Tsurugi, Kawati to Minokosi, altitude 1,400 meters, May 30, 1950 (*Issiki-Ito*); Minokosi, altitude 1,400 meters, to Nagoro, altitude 900 meters, June 1, 1950 (*Issiki-Ito*).

IYO: Mount Ishizuchi, altitude 1,400 to 1,981 meters, June 9, 1950 (*Issiki-Ito*).

TOSA: Mount Imanoyama, altitude 865 meters, May 12, 1951 (*Issiki-Ito*).

The materials from Mount Tsurugi are almost typical *fuscipennis* while some of the other specimens, as from Mount Imanoyama, closely approach typical *serraticornis*. In the light of this apparently marked range of color of the wing I am placing *fuscipennis* in the synonymy but would indicate the possibility that further study may show that the two forms are separable as subspecies.

25. TRIOGMA KUWANAI (Alexander).

Liogma kuwanai ALEXANDER, Canadian Ent. 45 (1913) 321–322, *pl. 4, fig. 4* (wing), *pl. 10, figs. 13–15* (♂ hypopygium).

Triogma kuwanai ESAKI, et al., Icon. Insect. Japon. Ed. 2 (1950) 1513, *fig.*

IYO: Misaka-toge, altitude 716 meters, May 3, 1951 (*Yano*); Mount Saragamine, altitude 1,271 meters, May 8, 1949 (*Miyatake*); Sugitate, April 8, 1950 (*Miyatake*).

25a. TRIOGMA KUWANAI LIMBINERVIS subsp. nov.

Very similar to the typical form, differing especially in the broad darkened seams over the cord and outer end of cell 1st M_2, and also at the wing tip, continued basad along the posterior wing margin. In its most accentuated condition this is very striking but there is evidence of mergence with the typical form, where the wings are unpatterned or virtually so. Unfortunately no males are available and the hypopygia cannot be compared at this time.

The wing venation of the type series shows unusual variation in both the radial and medial fields. In the holotype, r–m is preserved as a very short element, m–cu is only about one-third its length beyond the fork of M, and cell 1st M_2 is elongate, nearly as long as vein M_{1+2} is beyond it. In the paratype, R_{4+5} is in direct longitudinal alignment with Rs, r–m being very long, exceeding m; m–cu is just beyond the fork of M, while cell 1st M_2 is about equal in length to the distal section of vein M_3. In the paratype, where the dark wing patern is most reduced, a long fusion of veins R_{4+5} and M_{1+2}, about equal in extent to m, has obliterated the r–m crossvein; m–cu is at near one-third the length of the long cell 1st M_2, or fully its own length beyond the fork of M. Such variation is extreme though indicated in other allied groups in the subfamily Cylindrotominæ.

Habitat.—Japan (Shikoku).

Holotype, female, Nisigawa, Tosa, altitude 700 to 1,000 meters, May 3, 1951 (*Issiki-Ito*). Paratopotype, sex?, badly broken, altitude 800 meters, May 4, 1951 (*Issiki-Ito*). Paratype, a badly damaged male, Mount Tsurugi, Awa, altitude 1,400 to 1,955 meters, May 31, 1950 (*Issiki-Ito*).

26. PHALACROCERRA MIKADO Alexander.

Phalacrocera mikado ALEXANDER, Ent. Soc. America. Ann. 12 (1919) 346.

AWA: Mount Tsurugi, Kawati to Minokosi, altitude 1,400 meters, May 30, 1950 (*Issiki-Ito*).

PEDICIINI

27. PEDICIA (PEDICIA) ISSIKIELLA sp. nov. **Plate 2, fig. 14.**

Size relatively large (wing, male, over 23 millimeters); general coloration of thorax light gray, the præscutum with four darker gray stripes; antennæ 13-segmented, very short, flagellum black; halteres yellow; femora yellow, the tips black, tibiæ and tarsi black; wings with the usual *Pedicia* pattern, the costal border chiefly pale, the dark seam along vein Cu narrow, dark brown, reaching the posterior border; basal abdominal tergites yellow, with a virtually complete black central stripe, outer segments more uniformly blackened, pruinose; male hypopygium with the dististyle terminal, the outer margin with about ten strong blackened spines.

Male.—Length, about 26 millimeters; wing, 23.5; antenna, about 2.

Female.—Length, about 25 millimeters; wing, 20.

Rostrum gray; palpi black. Antennæ 13-segmented, short, as shown by the measurements; scape black, heavily gray pruinose, pedicel dark brown, the apex yellowed, flagellum black, the base of the first segment yellowed; flagellar segments beyond the first short and crowded, with long unilaterally distributed verticils; outer three segments more slender, the long verticils more scattered. Head dark gray.

Pronotal scutum gray, more blackened on sides; posterior border of scutum and sides of scutellum more yellowed. Mesonotal præscutum light gray, with four darker gray stripes, the intermediate pair narrowly separated by a vague capillary pale line; posterior sclerites of notum dark gray, the parascutella pale. Pleura gray, the dorsopleural membrane obscure yellow below, more infuscated dorsally and surrounding the spiracle. Halteres yellow, the apex of knob a trifle more darkened. Legs

with the coxæ yellow, very pale gray pruinose; trochanters yellow; femora yellow basally, passing through brownish yellow, the tips narrowly but conspicuously black; tibiæ and tarsi black, the posterior tibiæ a trifle paler, with blackened tips. Wings with a handsome pattern of the usual *Pedicia* type, the costal border broadly fulvous brown, the remaining pattern dark brown, forming a solid mass in the outer radial field, including all of cells R_2 and R_3; seam along vein Cu narrow to very narrow, only about one-third as extensive as the broad seam over the cord, not or scarcely reaching the wing margin; disk cream-yellow, including the area within the dark triangle and likewise the broad bases of the cells beyond the cord from R_4 to M_4; remainder of wing, including the broad posterior border very pale brown; veins dark brown in the more heavily patterned portions, yellow or brownish yellow in the paler fields. Venation: Cord moderately oblique; cell R_4 merely three times its petiole; petiole of cell M_1 and m subequal.

Abdomen elongate; ground color yellow, the tergites with a conspicuous dorsomedian black stripe, this continuous on the proximal four segments, more expanded at posterior ends of the segments; lateral tergal borders narrowly gray pruinose; basal segment pruinose; sternites yellow, the posterior border of the first segment narrowly black, of the succeeding three narrowly yellow; outer segments more darkened, heavily pruinose; hypopygium black. Male hypopygium (Plate 2, fig. 14) with the dististyle, *d*, single, appearing as a broad flattened terminal blade, closely affixed to the basistyle, *b*, the suture not or scarcely evident; outer edge of dististyle with about ten strong curved black spines, with a few additional smaller ones near the anterior or beak portion, the latter extending over these spinules as an obtuse lobe. Interbase, *i*, appearing as a flattened yellow blade, the tip very obtuse to truncated.

Habitat.—Japan (Shikoku).

Holotype, male, Mount Tsurugi, Awa, Minokosi, altitude 1,400 meters, to Nagoro, 900 meters June 1, 1950 (*Issiki-Ito.*) Allotype, female, Mount Ishizuchi, Iyo, July 26, 1947 (*Takashi Kobayashi*). Paratype, male, Mount Saragamine, Iyo, altitude 1,271 meters, May 13, 1951 (*Miyatake*).

This interesting crane-fly is named for Professor Syuti Issiki, who has added greatly to our knowledge of the Tipulidæ of Japan and Formosa. The most nearly related species include *Pedicia* (*Pedicia*) *gaudens* (Alexander) and *P.* (*P.*) *grandior*

(Alexander), both of which are smaller and with the details of coloration of the body and wings distinct. The general structure of the male hypopygium is much the same in these species but with the details distinct. The male hypopygium of *grandior* is shown for comparison (Plate 2, fig. 15), being based on a somewhat diagrammatic outline of the holotype specimen and may be inaccurate in minor regards since it was made several years ago from the dry specimen. The present fly serves even more effectively to bridge the characters hitherto used to separate the two supposed valid subgeneric groups *Pedicia* and *Tricyphona*. Not only is it becoming increasingly difficult to maintain these as distinct but, further, the characters used to distinguish the genus *Dicranota* Zetterstedt are breaking down in similar manner. All of the supposedly valid Pediciine genera and subgenera are being maintained on very insufficient characters.

28. PEDICA (TRICYPHONA) INSULANA (Alexander).

Tricyphona insulana ALEXANDER, Can. Ent. 45 (1913) 319–320, *pl. 4, fig. 3* (venation).

AWA: Mount Tsurugi, altitude 1,400 to 1,955 meters, May 31, 1950 (*Issiki-Ito*).

TOSA: Totidani, near Yanasi, altitude 300 to 400 meters, May 2, 1951 (*Issiki-Ito*).

29. PEDICA (TRICYPHONA) PECTINATA (Alexander).

Tricyphona pectinata ALEXANDER, Philip. Jour. Sci. 44 (1931) 354, *pl. 1, fig. 10* (venation).

AWA: Mount Tsurugi, Sugeoi, June 4, 1950 (*Issiki-Ito*).

IYO: Mount Ishizuchi, altitude 1,400 meters, June 10, 1950 (*Issiki-Ito*).

30. PEDICA (TRICYPHONA) KIRISHIMENSIS (Alexander).

Tricyphona kirishimensis ALEXANDER, Philip. Jour. Sci. 35 (1928) 474–475, *pl. 1, fig. 6* (venation).

TOSA: Mount Imanoyama, altitude 865 meters, May 12, 1951 (*Issiki-Ito*).

The nearest relatives of the present fly are *Pedicia* (*Tricyphona*) *confluens* (Alexander) and *P.* (*T.*) *patens* Alexander.

31. PEDICIA (TRICYPHONA) FIMBRIATULA sp. nov. **Plate 2, figs. 13, 16.**

Size relatively large (wing, male, over 14 millimeters); mesonotal præscutum gray with four dark brown stripes, the posterior sclerites of the notum and the pleura clear gray; legs black, the femoral bases rather narrowly yellow; wings

brownish yellow, restrictedly patterned with brown; male hypopygium with the caudal margin of the ninth tergite produced medially into a flattened glabrous lobe, subtended on either side by long black lobes that bear very long yellow setæ; outer apical lobe of basistyle unusually slender, with numerous small black spines and with a very dense fringe of setæ down the face; outer end of basistyle with abundant long yellow setæ; dististyle a broadly flattened blade, the obtuse apex more thickened and darkened.

Male.—Length, about 14 millimeters; wing, 14.8; antenna, about 1.5.

Rostrum dark gray; palpi brownish black. Antennæ relatively long, 16-segmented, black throughout; basal flagellar segments cylindrical, the outer ones more elongate, well-constricted. Head grayish brown, the anterior vertex and narrow orbits light gray.

Pronotum dark gray. Mesonotal præscutum gray, with four dark brown stripes, the intermediate pair separated by a capillary dull gray line; scutal lobes with darkened centers; scutellum, postnotum and pleura clear gray. Halteres with stem pale yellow, knob weakly infuscated. Legs with the coxæ light gray; trochanters brown; remainder of legs black, the femoral bases rather narrowly brownish yellow. Wings (Plate 2, fig. 16) brownish yellow, the base light yellow; a restricted brown pattern, including the stigma and small seams at Sc_2, origin of Rs, R_2, and outer end of cell 1st M_2; a narrow but complete crossband at cord, reaching the stigma in front; extreme wing tip darkened; veins brown, those in prearcular field and basal half of Sc yellow. Venation: Rs relatively long, square and spurred at origin; m approximately its own length beyond the fork of M_{1+2} m-cu more than one-half its length beyond the fork of M_{3+4}.

Abdominal tergites dark brown, their posterior borders more pruinose; basal sternites darkened, the succeeding ones chiefly yellow; outer segments, including the hypopygium, blackened. Male hypopygium (Plate 2, fig. 13) with the caudal margin of the tergite, *9t*, produced medially into a flattened obtuse glabrous plate, subtended on either side by long black lobes that bear very long yellow setæ on their outer faces. Outer apical lobe of basistyle, *b*, unusually slender, with numerous small blackened spines, the mesal face with a fringe of rusty brown setæ arranged in a single very dense row; outer surface of basistyle before the lobe with abundant long yellow setæ,

the punctures close together. Interbase, *b*, stout, narrowed to an apical beak which is slightly upturned at tip. Dististyle, *d*, a broadly flattened blade, the obtuse apex more thickened and darkened, with several erect setæ.

Habitat.—Japan (Shikoku).

Holotype, male, Mount Tsurugi, Awa, Minokosi, altitude 1,400 meters, to Nagoro, 900 meters, June 1, 1950 (*Issiki-Ito*).

The most similar described regional species is *Pedicia* (*Tricyphona*) *seticauda* (Alexander), which differs evidently in the structure of the male hypopygium, particularly the tergite and basistyle.

32. PEDICA (TRICYPHONA) SETICAUDA (Alexander).

Tricyphona seticauda ALEXANDER, Ann. and Mag. Nat. His. (9) 15 (1925) 77–78.

IYO: Omogokei, July 26, 1947 (*Kazuo Ishimaru*).

More material may show that the present fly is at least subspecifically distinct from *seticauda*.

33. PEDICA (NASITERNELLA) VARIINERVIS HOKKAIDENSIS Alexander.

Limnobia variinervis ZETTERSTEDT, Dipt. Scandinaviæ 10 (1851) 3813.

Amalopis variinervis OSTEN SACKEN, Monog. Dipt. N. Amer. 4 (1869) 264.

Nasiterna variinervis WALLENGREN, Ent. Tidskr. 2 (1881) 191.

Pedicia (*Nasiternella*) *hokkaidensis* ALEXANDER, Philip. Jour. Sci. 53 (1934) 278–279, *pl. 1, fig. 7* (venation), *pl. 2, fig. 29* (♂ hypopygium).

AWA: Mount Tsurugi, altitude 1,400 to 1,955 meters, May 31, 1950 (*Issiki-Ito*).

Hitherto known from Hokkaido and northern Korea.

34. HETERANGÆUS JAPONICUS (Alexander).

Polyangæus japonicus ALEXANDER, Ent. Soc. America. Ann. 12 (1919) 342.

Heterangæus japonicus ALEXANDER, Ann. and Mag. Nat. Hist. (9) 15 (1925) 79.

AWA: Mount Tsurugi, Kawati to Minokosi, altitude 1,400 meters, May 30, 1950 (*Issiki-Ito*).

IYO: Omogokei, July 22, 1949 (Miyatake); Mount Ishizuchi, altitude 1,400 to 1,981 meters, June 9, 1950 (*Issiki-Ito*).

TOSA: Imanoyama, altitude 865 meters, May 12, 1951 (*Issiki-Ito*).

35. DICRANOTA (RHAPHIDOLABIS) CLAUSA Alexander. **Plate 2, fig. 17.**

Dicranota (*Rhaphidolabis*) *clausa* ALEXANDER, Philip. Jour. Sci. 66 (1938) 115–117, *pl. 1, fig. 13* (venation), *pl. 3, fig. 38* (♂ hypopygium).

AWA: Mount Tsurugi, Kawati to Minokosi, altitude 1,400 meters, May 30, 1950 (*Issikiti-Ito*).

One female, very similar to the type except in slight details of venation (Plate 2, fig. 17). Cell R_3 sessile, there being a short element R_{4+5}; cell M_1 deeper, about one-third to one-half longer than its petiole.

36. DICRANOTA (RHAPHIDOLABIS) GIBBERA (Alexander).

Rhaphidolabina gibbera ALEXANDER, Ent. Soc. America. Ann. 14 (1921) 121.

Dicranota (*Rhaphidolabis*) *gibbera* ALEXANDER, Arkiv för Zoologi (2) 42 A (1949) 18.

Amalopina gibbera ESAKI, et al., Icon. Insect. Japon. Ed. 2 (1950) 1521, *fig.*

IYO: Mount Ishizuchi, altitude 1,400 meters, June 10, 1950 (*Issiki-Ito*). An unusually large female specimen.

By my latest key to the subgenera of the genus *Dicranota* Zetterstedt,[14] the present fly is included in the subgenus *Rhaphidolabis* Osten Sacken.

37. DICRANOTA (RHAPHIDOLABIS) IDIOPYGA sp. nov. **Plate 2, fig. 12.**

Size small (wing, male, 5.7 mm); mesonotum obscure brownish yellow, darker medially, especially on the gibbous præscutum; legs obscure yellow, the outer tarsal segments weakly distinct, longer than the R_{2+3+4} infuscated; wings subhyaline; R basal section of R_5; m-cu nearly its own length beyond the fork of M; abdomen brown, the genitalia more yellowed; male hypopygium with the tergite very large, each outer lateral angle produced into a flattened sclerotized plate that is extended into a slender rod, the median region of tergite with a conspicuous narrow lobe; outer apical angle of basistyle produced laterad into a strong point; interbase short and compact, at apex split into two strong teeth.

Male.—Length, about 4.6 millimeters, wing, 5.7; antenna, about 0.6.

Female.—Length, about 5 millimeters; wing, 6.

Rostrum light brown; palpi darker. Antennæ apparently 12-segmented, brownish black; flagellar segments oval, a little exceeding the longest verticils. Head dark gray.

Pronotum brownish yellow, paler on sides. Mesonotum obscure brownish yellow laterally, darker brown medially, especially on the unusually high and gibbous præscutum. Pleura and pleurotergite brownish yellow. Halteres with stem yellow,

[14] Alexander, C. P. Arkiv för Zoologi (2) 42 A (1949) 17–18.

knob weakly infuscated. Legs with the coxæ brownish yellow; trochanters yellow; remainder of legs obscure yellow, the outer tarsal segments weakly infuscated. Wings subhyaline, the stigma not or scarcely darkened; veins pale brown. Venation: Sc_2 very far basad, at about one-third the distance between arculus and origin of Rs; R_2 transverse, longer than R_{1+2}; R_{2+3+4} present, longer than the basal section of R_5; m-cu nearly its own length beyond the fork of M.

Abdomen brown, the genitalia more yellowed. Male hypopygium very distinctive (Plate 2, fig. 12). Ninth tergite, *9t*, very large, each outer lateral angle produced into a flattened sclerotized plate that is extended into a slender rod, the mesal margin near base with a smaller fingerlike lobe; at base of notch with the usual tergal lobe, this relatively long, parallel-sided, its apex with numerous strong setæ that are directed caudad. Basistyle, *b*, with the outer apical angle produced laterad into a strong point. Interbase very short and stout, the apex divided into two (or possibly three) strong teeth. Dististyles, *d*, apparently two, the outer a narorw lobe that is densely set with spinulose setæ; inner style a flattened blade, the apex obtuse, nearly glabrous except for a small marginal group of setæ near apex and more numerous and conspicuous setæ over the basal part; it is possible that this latter structure is actually an inner apical blade of the basistyle rather than being a dististyle.

Habitat.—Japan (Shikoku).

Holotype, male, Mount Tsurugi, Awa, Kawati to Minokosi, altitude 1,400 meters, May 30, 1950 (*Issiki-Ito*). Allotopotype, female, Minokosi, altitude 1,400 meters, to Nagoro, 900 meters, June 1, 1950 (*Issiki-Ito*).

In its general appearance this very distinct fly suggests species such as *Dicranota* (*Rhaphidolabis*) *consors* Alexander, differing from all in the entirely different male hypopygium.

38. DICRANOTA (EUDICRANOTA) DICRANOTOIDES (Alexander).

Rhaphidolabina dicranotoides ALEXANDER, Ent. Soc. America. Ann. 17 (1924) 72-73.

Dicranota (*Eudicranota*) *dicranotoides* ALEXANDER, Arkiv för Zoologi (2) 42 A (1949) 18.

IYO: Mount Iskizuchi, altitude 1,400 meters, to Koguti, 300 meters, June 11, 1950 (*Issiki-Ito*).

39. ULA (ULA) CINCTA Alexander.

Ula cincta ALEXANDER, Philip. Jour. Sci. 24 (1924) 573.

AWA: Mount Tsurugi, Minokosi, altitude 1,400 meters, to Nagoro, 900 meters, May 30, 1950 (*Issiki-Ito*).

HEXATOMINI

40. LIMNOPHILA (EUTONIA) SATSUMA (Westwood).

Limnobia satsuma WESTWOOD, Ent. Soc. London Trans. (1876) 504, *pl. 3, figs. 5a, 5b* (wing).

Limnophila (Poecilostola) satsuma ALEXANDER, Can. Ent. 45 (1913) 314–316, *pl. 3, fig. 4* (wing), *pl. 10, fig. 11* (♂ hypopygium).

Gagamba Takei MATSUMURA, Thous. Ins. Japan Addit. 2 (1916) 471–473, *pl. 25, fig. 12* (whole ♂),

Limnophila satsuma ESAKI, et al., Icon. Insect. Japon. Ed. 2 (1950) 1523, *fig.*

IYO: Mount Saragamine, altitude 1,271 meters, July 23, 1949 (*Ishihara*).

41. LIMNOPHILA (PRIONOLABIS) RECURVANS sp. nov. **Plate 2, figs. 18, 23.**

Size small (wing less than 7 millimeters); general coloration black, the surface dull; antennæ 16-segmented, black throughout; halteres yellow; legs black, the posterior femora paler; wings rather strongly infuscated, the prearcular field more yellowed; cell M_1 lacking; male hypopygium with a single subterminal tooth on outer dististyle; inner dististyle unequally bifid at apex; gonapophysis appearing as a slender blackened rod, the apex recurved into a long point, in cases with a smaller hook or blunt point at the bend.

Male.—Length, about 6.5 millimeters; wing 6.5 to 6.8; antenna, about 1.1 to 1.2.

Female.—Length, about 6 millimeters; wing, 6.

Rostrum and palpi black. Antennæ black throughout, 16-segmented; flagellar segments short-oval, less than the verticils. Head dull black.

Thorax almost uniformly dull black, the præscutum faintly nitidous, the pleura more heavily dusted. Halteres pale yellow. Legs black, the posterior pair in cases paler; femora brownish yellow, darkening to brownish black at tips; tibiæ and tarsi dark brown to black. Wings (Plate 2, fig. 18) rather strongly infuscated, the oval stigma a trifle darker, the very restricted prearcular field more yellowed; veins brown, those of the wing base yellow. Venation: R_{2+3+4} and basal section of R_5 subequal; cell M_1 lacking.

Abdomen, including hypopygium, black. Male hypopygium (Plate 2, fig. 23) having the posterior border of the tergite, *9t*, with a U-shaped emargination, subtended by a low broad

lobe on either side. Outer dististyle, *d*, with a single major tooth at near two-thirds the length; outer subtending lobe narrow, outer face of style microscopically scabrous. Inner dististyle unequally bifid at apex. Gonapophysis, *g*, appearing as a slender blackened rod, the apex recurved into a long point, in cases with a smaller hook or blunt point at the bend. Aedeagus, *a*, rather broadly flattened.

Habitat.—Japan (Shikoku).

Holotype, male, Nisigawa to Yanase, Tosa, altitude 600 meters, May 4, 1951 (*Issiki-Ito*). Allotype, female, Iwai, near Imanoyama, Tosa, altitude 200 meters, May 11, 1951 (*Issiki-Ito*). Paratopotype, male, with the holotype.

The present fly is most similar to species such as *Limnophila* (*Prionolabis*) *liponeura* Alexander and *L.* (*P.*) *lipophleps* Alexander, differing in the details of coloration, as of the wings, and especially in the structure of the male hypopygium, particularly the gonapophyses.

42. LIMNOPHILA (PRIONOLABIS) SHIKOKUANA sp. nov. Plate 2, figs. 19, 24.

Size small (wing, male, about 6 millimeters); general coloration black; antennæ 16-segmented; halteres yellow; legs black, only the femoral bases narrowly yellow; wings faintly tinged with brown, the prearcular field conspicuously light yellow; cell M_1 lacking; male hypopygium with the outer dististyle a simple blade, without basal lobe; inner dististyle a simple rod, its apical fourth more narrowed; gonapophysis slender at base, before midlength dilated into an oval swelling, thence abruptly narrowed into a long curved black spine, its margins entirely smooth.

Male.—Length, about 6 millimeters; wing, 6.2; antenna, about 1.4.

Female.—Length, about 6.5 millimeters; wing, 7.

Rostrum black, sparsely pruinose; palpi black. Antennæ black throughout, 16-segmented; flagellar segments oval, the terminal one about one-half longer than the penultimate; longest verticils subequal in length to the segments. Head black, sparsely pruinose, more heavily so in front.

Thorax uniformly black. Halteres light yellow. Legs black, the extreme bases of the femora yellow, a trifle more extensive on the fore legs. Wings (Plate 2, fig. 19) with a faint brownish tinge, the prearcular field light yellow; stigma long-oval, pale brown, poorly delimited; veins brown, yellow in the prearcular field. Venation: R_{2+3+4} slightly variable in length, up to

one-half longer than the basal section of R_5; cell M_1 lacking; m-cu at or just before midlength of cell 1st M_2.

Abdomen, including hypopygium, black. Male hypopygium (Plate 2, fig. 24) with the tergite, *9t*, transverse, the caudal margin with two obtuse lobes that are separated by a broad shallow emargination. Outer dististyle, *d*, a simple blade, without outer basal lobe, narrowed gradually into a long black apical spine; outer surface and margin of distal half with microscopic appressed spinulæ. Inner dististyle a simple rod, the apical quarter more narrowed. Gonapophysis, *g*, with the base slender, before midlength conspicuously dilated into an oval swelling, thence abruptly narrowed into a long curved black spine with smooth margins. Aedeagus, *a*, darkened, narrowly compressed-reniform.

Habitat.—Japan (Shikoku).

Holotype, male, Mount Tsurugi, Awa, altitude 1,400 to 1,955 meters, May 31, 1950 (*Issiki-Ito*). Allotype, female, Mount Tsurugi, Minokosi, altitude 1,400 meters, to Nagoro, 900 meters, June 1, 1950 (*Issiki-Ito*).

Limnophila (*Prionolabis*) *shikokuana* is readily told from the other regional members of the subgenus that have lost cell M_1 of the wings by the very distinct structure of the male hypopygium. Such species include *L.* (*P.*) *inermis* Alexander, *L.* (*P.*) *liponeura* Alexander, *L.* (*P.*) *lipophleps* Alexander, *L.* (*P.*) *recurvans* sp. nov., and *L.* (*P.*) *serridentata* Alexander.

43. LIMNOPHILA (DENDROLIMNOPHILA) SHIKOKUENSIS sp. nov.

Plate 2, figs. 20, 25.

General coloration fulvous yellow; antennæ short; legs dirty whitish, the outer tarsal segments darker; wings brownish yellow, veins pale; m-cu at or near midlength of cell 1st M_2; male hypopygium with the tergite produced into two long slender spines; basistyle with a row of about 15 long bristles on mesal face; inner dististyle pale, the lower margin deeply notched at near midlength; phallosome including three sets of spines or blades, additional to the ædeagus.

Male.—Length, about 4.5 to 5 millimeters; wing, 6 to 6.2; antenna, about 1.0 to 1.1.

Female.—Length, about 5 millimeters; wing, 5.5.

Rostrum and palpi yellow. Antennæ short; scape brownish yellow, flagellum dark brown; flagellar segments subcylindrical, shorter than the verticils. Head yellow, sparsely pruinose.

Thorax uniformly fulvous yellow, without pattern. Halteres yellow. Legs obscure dirty whitish, the outer tarsal segments a trifle darker; tibial spurs conspicuous. Wings (Plate 2, fig. 20) almost uniformly brownish yellow to weakly fulvous, unpatterned; veins pale, only a little darker than the ground. Venation: So short, Sc_1 ending some distance before fork of Rs, Sc_2 at its extreme tip; R_{2+3+4} about twice the basal section of R_5; R_2 pale and ill-defined, subequal to R_{1+2} cell M_1 lacking; m-cu at or near midlength of cell 1st M_2.

Abdomen yellow, the hypopygium somewhat paler yellow. Ovipositor with the valves long and nearly straight. Male hypopygium (Plate 2, fig. 25) with the basistyle, *b*, stout, on mesal face at near midlength with a dense longitudinal row of about 15 long yellow bristles; more basad on style with a loose group of smaller setæ; remaining setæ of style scattered. Both dististyles, *d*, terminal, glabrous; outer style slender, the tip narrowed and produced, blackened, the extreme apex shallowly bidentate; at point of narrowing on outer margin with a small blackened tooth; inner style larger, pale, narrowed outwardly, the lower margin at near midlength deeply and narrowly notched. Phallosome, *p*, complex, including stout dusky lateral blades that narrow to an acute point on their inner apical angle; the central phallosomic mass includes, besides the ædeagus, two stouter rods that narrow at apex into long straight spines; in addition two more central acute spinous points. Besides the above, what evidently pertains to the tergite appears as a major pale structure that is produced caudad into two slender spines that gently diverge outwardly (this plate and its spines are not shown in the figure).

Habitat.—Japan (Shikoku).

Holotype, male, Nisigawa to Kokusen, near Yanase, Tosa, altitude 600 meters, May 4, 1951 (*Issiki-Ito*). Allotopotype, female. Paratopotype, 3 males.

The subgenus *Dendrolimnophila* Alexander was based on a single species, *albomanicata* Alexander, known only from the Vancouveran region of the Pacific Northwest of North America.[15] The discovery of a second species is of unusual interest. The two flies while being generally similar and evidently allied, differ conspicuously in the structure of the male hypopygium, including the tergite, basistyle, both dististyles, and the phallosome.

[15] Alexander, C. P. Amer. Midland Nat. 42 (1949) 314, *figs. 44, 47.*

44. ULOMORPHA NIGRICOLOR Alexander.

Ulomorpha nigricolor ALEXANDER, Ann. and Mag. Nat. Hist. (9) 15 (1925) 75–76.

IYO: Mount Ishizuchi, altitude 1,400 meters, to Koguti, 300 meters, June 11, 1950 (*Issiki-Ito*); Yuyama, May 9, 1948 (*Miyatake*).

One of the specimens is larger than the type (wing, female, 9.5 millimeters) and with more strongly infuscated wings; the darker pattern is less evident, cell R_3 entirely sessile; cell 1st M_2 subequal in length to vein M_4.

45. HEXATOMA (HEXATOMA) JAPONICA Alexander.

Hexatoma japonica ALEXANDER, Insec. Inscit. Menst. 10 (1922) 185–186.

IYO: Omogokei, July 26, 1948 (*Isao Tomari*).

46. HEXATOMA (ERIOCERA) ALBOGUTTATA (Matsumura).

Eriocera alboguttata MATSUMURA, Thous. Ins. Japan Addit. 2 (1916) 468–469, *pl. 25, fig. 10* (whole ♀).

Eriocera hilpa ESAKI, et al., (Nec Walker), Icon. Insect. Japon. Ed. 2 (1950) 1524, *fig.*

IYO: Sugitate, September 12, 1951 (*Ishihara*); Mount Takanawa, altitude 986 meters, August 20, 1948 (*Teruo Koyama*).

Originally described from Honshu, Shikoku and Kyushu. The Shikoku material was from Iyo, without more exact data.

47. HEXATOMA (ERIOCERA) STRICKLANDI STRICKLANDI (Edwards).

Eriocera stricklandi EDWARDS, Ann. and Mag. Nat. Hist. (9) 8 (1921) 82.

IYO: Mount Saragamine, altitude 1,271 meters, July 23, 1946, July 22, 1949 (*Ishihara*). Two females, both having extruded great masses of pale-colored eggs.

Edwards' type, a female, was from an unknown locality in Japan (*T. A. G. Strickland,* 1909).

47a. HEXATOMA (ERIOCERA) STRICKLANDI PALLIDIBASIS subsp. nov.

Generally similar to the typical form but with distinctive leg pattern. All femora yellowed basally, with approximately the outer half blackened. In typical *stricklandi,* the blackened tips of the fore and middle femora are narrow and abrupt, involving about the outer fourth, or fifth, posterior femora chiefly black, with about the proximal fifth or less yellowed. The wings are rather heavily seamed with dusky along the veins but this pattern is approached by some specimens of typical *stricklandi* in my collection.

Holotype, female, Mount Ishizuchi, Iyo, July 20, 1948 (*Tokashi Kobayashi*).

48. HEXATOMA (ERIOCERA) LONGIFURCA (Alexander).

Eriocera longifurca ALEXANDER, Amer. Ent. Soc. Trans. 46 (1920) 14.
Eriocera longifurca ESAKI, et al., Icon. Insect. Japon. Ed. 2 (1950) 1524, *fig.*

IYO: Sugitate, April 8, 1950 (*Miyatake*).

ERIOPTERINI

49. CONOSIA IRRORATA (Wiedemann).

Limnobia irrorata WIEDEMANN, Aussereur. zweifl. Ins. 1 (1828) 574.
Conosia irrorata VAN DER WULP, Tijd. voor Ent. 23 (1880) 159.
Conosia irrorata ALEXANDER, Can. Ent. 45 (1913) 293, *pl. 8, fig. 13* (wing).
Limnophila crux DOLESCHALL, Tijd. Nederl. Indie 14 (1857) 388, *pl. 4, fig. 3* (wing).
Limnobia substituta WALKER, List. Dipt. Brit. Mus. (1848) 39.
Conosia irrorata ESAKI, et al., Icon. Insect. Japon. Ed. 2 (1950) 1526, *fig.*

IYO: Dogo, Matsuyama, September 8, 1945 (*Yano*).

50. CLADURA (CLADURA) DECEM-NOTATA Alexander. **Plate 2, fig. 27.**

Cladura decem-notata ALEXANDER, Ent. Soc. America Ann. 17 (1924) 436–437.
Cladura decem-notata ALEXANDER, Philip. Jour. Sci. 40 (1929) 540.

IYO: Sugitate, November 1, 1951 (*Ishihara*).

The types, represented only by females, were from various stations in Kyushu. What was assumed to represent this same species was later (1929) recorded from Formosa, at high altitudes but this was still later found to be erroneous, the latter material being [16] described as a new species under the name *Cladura taiwania*. Since these two species have been confused it seems advisable to provide descriptions of the male hypopygia which provide ready recognition characters.

Cladura decem-notata (Plate 2, fig. 27) has the tergite, *9t*, produced medially, with a very small V-shaped notch, the very broad lobes truncated; surface of tergite with scattered setæ. Basistyle, *b*, relatively slender, without strong concentrations of setæ on mesal face. Dististyle, *d*, deeply split into two apical arms, the axial one more slender, parallel-sided for most of its length; lower arm with setæ but these not forming a distinct marginal fringe. Gonapophysis, *g*, relatively short, produced into three or four small points. Aedeagus, *a*, very long, dilated or provided with a flange on the subapical third.

[16] Alexander, C. P. Ent. Soc. America Ann. 40 (1947) 360–361.

Cladura taiwania Alexander (Plate 2, fig. 28) with the tergite, *9t,* much as in *decem-notata,* the surface with even sparser setæ. Basistyle, *b,* stouter, the mesal face near apex with a concentration of strong setæ, arranged in two more or less distinctly separate groups. Dististyle, *d,* narrowed at base, thence dilated into a triangular blade, the apex shallowly emarginate, the lower lobe fringed with strong setæ along its margin. Gonapophysis, *g,* produced into a narrow blade, on outer margin with a low tooth or flange. Ædeagus, *a,* relatively short and stout, nearly equally dilated or flanged except on the strongly narrowed outer fifth.

51. CLADURA (CLADURA) SERRIMARGO sp. nov. **Plate 2, figs. 21, 25.**

General coloration yellow, unpatterned; femora and tibiæ obscure yellow, the extreme tips darkened; wings whitish, the prearcular field a little more yellowed; macrotrichia of veins, including the costal field, long and conspicuous; r-m long and arcuated; male hypopygium with the caudal margin of tergite produced into two small lobes; dististyle stout, the apex produced into an obtuse beak, the outer or dorsal surface without setæ; gonapophysis appearing as a flattened blade, the outer margin before apex produced into a spinous tooth, back from this point along the margin with five or six small serrations.

Male.—Length, about 7.5 millimeters; wing, 8; antenna, about 1.3.

Rostrum and palpi yellow. Antennæ yellow, the outer flagellar segments slightly darker; verticils long and conspicuous, approximately twice the segments. Head yellow.

Thorax pale yellow, the pleura even paler, more whitened. Halteres yellow. Legs with the coxæ and trochanters yellow; femora and tibiæ obscure yellow, the extreme tips darkened; tarsi brownish yellow, passing into black. Wings (Plate 2, fig. 21) whitish, the prearcular field a little more yellowed, the costal region less evidently so; veins brown, paler in the brightened areas. Macrotrichia of veins long and conspicuous; costal fringe relatively long. Venation: R_{2+3} about one-third to one-half longer than R_{1+2}; inner end of the small cell first M_2 lying some distance beyond the level of cell R_5, r-m being long and arcuated; cell M_1 about three times its petiole; m-cu at or close to fork of M.

Abdomenal tergites chiefly brown, the ninth segment more heavily so on sides; sternites and hypopygium obscure yellow.

Male hypopygium (Plate 2, fig. 25) with the median region of the tergite, *9t*, glabrous, dusky in color, projecting beyond the level of the posterior border as two lobes, separated by a U-shaped notch. Basistyle, *b*, elongate, with abundant setæ on mesal face, including the more protuberant cephalic part. Dististyle, *d*, stout, irregular in outline, the apex produced into an obtuse beak, the surface with abundant setæ that are lacking on the dorsal area. Phallosome simple, the slender ædeagus subequal in length to the gonapophyses, the latter, *g*, appearing as flattened blades, the outer margin before apex produced into a spinous tooth, back from this point along the margin with five or six small serrations; inner apical part of the blade less produced, with delicate setulæ.

Habitat.—Japan (Shikoku).

Holotype, male, Sugitate, Iyo, November 1, 1951 (*Ishihara*).

The most similar regional species is *Cladura* (*Cladura*) *autumna* Alexander, which differs chiefly in details of structure of the male hypopygium, as the dististyle and gonapophysis.

52. GYMNASTES (PARAGYMNASTES) FLAVITIBIA (Alexander).

Gymnastes flavitibia ESAKI, et al., Icon. Insect. Japon. Ed. 2 (1950) 1526, *fig.*

Paratropeza flavitibia ALEXANDER, Ent. Soc. America. Ann. 12 (1919) 333–334.

IYO: Omogokei, July 31, 1949 (*Miyatake*); Setokazetoge, altitude 212 meters, July 8, 1949 (*Yano*).

53. ORMOSIA (ORMOSIA) CONFLUENTA Alexander.

Ormosia confluenta ALEXANDER, Insec. Inscit. Menst. 10 (1922) 182–183.

AWA: Mount Tsurugi, altitude 1,400 to 1,955 meters, May 31, 1950 (*Issiki-Ito*).

54. ORMOSIA (ORMOSIA) REMISSA sp. nov. **Plate 2, figs. 22, 29.**

Belongs to the *similis* group; wings pale yellow, weakly patterned with brown, including the stigma and a narrow seam over the cord; male hypopygium with the ædeagus flanged basally, the outer third very strongly sinuous; three pairs of spinous gonapophyses, the longest produced into a very long slender point.

Male.—Length, about 4.5 millimeters; wing, 5.

Body of type badly crushed and broken. Wings (Plate 2, fig. 22) with the ground color pale yellow, more saturated at base; a restricted dark pattern, including the oval stigma and a narrow seam over the cord; less evident darkenings include

the ends of the longitudinal veins back from the margin, best evidenced by a deepening in color of the otherwise yellow veins; basad of cord darkenings very reduced to virtually lacking. Venation: Sc_1 ending just beyond level of R_2, Sc_2 about opposite one-third the length of Rs; R 1+2 reduced; vein R_3 strongly upcurved at outer end; vein 2nd A strongly sinuous, narrowing the cell on the distal third.

Male hypopygium (Plate 2, fig. 29) with the ninth tergite, *9t*, produced medially, the lobe with a pale central line. Outer dististyle, *d*, much smaller than the inner, with parallel rows of spinous setæ, as in the group; inner dististyle broadly flattened, at apex farther produced into a short fingerlike lobe. Phallosome, *p*, with the ædeagus flanged basally, the slender outer third very strongly sinuous. Gonapophyses, *g*, including three pairs of spines, these being a stout blackened rod, a longer apophysis that is bent virtually at a right angle before midlength, its outer point produced into a very long slender spine, and a short slender blackened spine from a dilated base.

Habitat.—Japan (Shikoku).

Holotype, a broken male, Mount Tsurugi, Awa, altitude 1,400 to 1,955 meters, May 31, 1950 (*Issiki-Ito*).

The present fly is most similar to species such as *Ormosia* (*Ormosia*) *dicax* Alexander and *O.* (*O.*) *seclusa* Alexander, differing evidently in the details of venation and, especially, the structure of the male hypopygium.

55. ORMOSIA (ORMOSIA) TAKEUCHII Alexander.

Ormosia takeuchii ALEXANDER, Ent. Soc. America Ann. 14 (1921) 117–118.

Ormosia takeuchii ESAKI, et al., Icon. Insect. Japon. Ed. 2 (1950) 1526, *fig.*

AWA: Mount Tsurugi, Minokosi, altitude 1,400 meters, to Nagoro, 900 meters, June 1, 1950 (*Issiki-Ito*).

IYO: Sugitate, November 1, 1951 (*Ishihara*).

56. ERIOPTERA (PSILOCONOPA) ASYMMETRICA Alexander.

Erioptera (*Acyphona*) *asymmetrica* ALEXANDER, Can. Ent. 45 (1913) 289–290, *pl. 3, fig. 15* (wing), *pl. 10, figs. 7–8* (♂ hypopygium).

Erioptera asymmetrica ESAKI, et al., Icon. Insect. Japon. Ed. 2 (1950) 1527, *fig.*

IYO: Matsuyama, April 28, 1947 (*Yano*).

57. ERIOPTERA (ERIOPTERA) ELEGANTULA Alexander.

Erioptera (*Erioptera*) *elegantula* ALEXANDER, Can. Ent. 45 (1913) 290–291, *pl. 3, fig. 3* (wing).

IYO: Matsuyama, March 18, 1949 (*Miyatake*).

58. ERIOPTERA (ERIOPTERA) ORIENTALIS Brunetti.

Erioptera orientalis BRUNETTI, Fauna Brit. India, Dipt. Nematocera (1912) 453–454.

Erioptera (*Erioptera*) *dictenidia* ALEXANDER, Ent. Soc. America Ann. 14 (1921) 115–116.

IYO: Matsuyama, May 22, 1948 (*Miyatake*).

The species is wide-spread in eastern and southern Asia.

59. MOLOPHILUS (MOLOPHILUS) PEGASUS Alexander.

Molophilus pegasus ALEXANDER, Can. Ent. 45 (1913) 291–293, *pl. 3, fig. 11* (wing), *pl. 10, figs. 3–4* (♂ hypopygium).

IYO: Mount Ischizuchi, altitude 1,400 to 1,981 meters, June 9, 1950 (*Issiki–Ito*).

60. MOLOPHILUS (MOLOPHILUS) ITOANUS sp. nov. **Plate 2, fig. 30.**

Belongs to the *gracilis* group, general coloration dark gray; halteres blackened; legs black; wings strongly infuscated; male hypopygium with the mesal lobe of the basistyle narrowed into a very long black spine that bears a small acute thorn on outer margin before midlength.

Male.—Length, about 3.8 millimeters; wing, 4.3.

Rostrum and palpi brownish black. Antennæ with the scape and pedicel brownish black; flagellum broken. Head dark gray.

Pronotum dark brown. Thorax uniformly dark gray, the pseudosutural foveæ and tuberculate pits black. Halteres blackened, the base of stem narrowly brightened. Legs with the coxæ brown, gray pruinose; trochanters brownish testaceous; remainder of legs black, the extreme femoral bases vaguely yellowed. Wings strongly infuscated; veins and macrotrichia darker brown, the latter long and conspicuous. Venation: R_2 in transverse alignment with r-m; petiole of cell M_3 nearly three times m-cu; vein 2nd A long and sinuous, ending a short distance beyond m-cu.

Abdomen brownish black, pruinose. Male hypopygium (Plate 2, fig. 30) with the basistyle, *b*, unusually complex; dorsal lobe, *db*, moderately long, narrowed to the obtuse tip, the outer face with scattered very long pale setæ, those at apex much shorter and more delicate; ventral lobe, *vb*, strongly clavate, about one-half broader near apex than at base, the upper surface with scattered setæ of very unusual length, the expanded apical part with numerous yellow setæ that are more or less retrorse; mesal lobe, *mb*, narrowed into a very long slender black spine, its outer margin before midlength with a straight acute thorn.

Outer dististyle, *d*, a sinuous blackened rod that narrows very gradually into a long straight spine. Inner dististyles broken beyond their base, as shown, the part remaining with several strong spines on outer margin. Phallosomic plate oval, the surface with microscopic setulæ. Aedeagus relatively short and stout.

Habitat.—Japan (Shikoku).

Holotype, male, Mount Tsurugi, Sugeoi, Awa, June 4, 1950 (*Issiki–Ito*).

I take unusual pleasure in dedicating this very distinct fly to Professor Syusiro Ito to whom I am indebted for many interesting Tipulidæ from Honshu, Kyushu, and Shikoku. The male hypopygium readily separates the species from all other regional members of the group. It is most similar to species such as *Molophilus* (*Molophilus*) *polycanthus* Alexander but is entirely distinct, particularly in hypopygial characters.

ILLUSTRATIONS

[Legend: *a*, aedeagus; *b*, basistyle; *d*, dististyle; *db*, dorsal lobe of basistyle; *g*, gonapophysis; *i*, interbase; *mb*, mesal lobe of basistyle; *o*, ovipositor; *p*, phallosome; *s*, sternites; *t*, tergites; *vb*, ventral lobe of basistyle.]

PLATE 1

FIG. 1. *Longurio* (*Longurio*) *yanoi* sp. nov.; venation.
2. *Dictenidia miyatakei* sp. nov.; venation.
3. *Longurio* (*Longurio*) *yanoi* sp. nov.; male hypopygium.
4. *Tipula* (*Trichotipula*) *politonigra* sp. nov.; male hypopygium, details.
5. *Tipula* (*Oreomyza*) *imitator* sp. nov.; male hypopygium, details.
6. *Tipula* (*Yamatotipula*) *tsurugiana* sp. nov.; male hypopygium, details.
7. *Tipula* (*Yamatotipula*) *misakana* sp. nov.; male hypopygium, details.
8. *Tipula* (*Lunatipula*) *naviculifer naviculifer* Alexander; male hypopygium, details.
9. *Tipula* (*Lunatipula*) *naviculifer breviscapha* subsp. nov.; male hypopygium, details.
10. *Tipula* (*Lunatipula*) *naviculifer breviscapha* subsp. nov.; ovipositor, dorsal aspect.
11. *Tipula* (*Lunatipula*) *shogun* Alexander; ovipositor, dorsal aspect.
12. *Dicranota* (*Rhaphidolabis*) *idiopyga* sp. nov.; male hypopygium.

PLATE 2

FIG. 13. *Pedicia* (*Tricyphona*) *fimbriatula* sp. nov.; male hypopygium.
14. *Pedicia* (*Pedicia*) *issikiella* sp. nov.; male hypopygium.
15. *Pedicia* (*Pedicia*) *grandior* (Alexander); male hypopygium, styli.
16. *Pedicia* (*Tricyphona*) *fimbriatula* sp. nov.; venation.
17. *Dicranota* (*Rhaphidolabis*) *clausa* Alexander; venation.
18. *Limnophila* (*Prionolabis*) *recurvans* sp. nov.; venation.
19. *Limnophila* (*Prionolabis*) *shikokuana* sp. nov.; venation.
20. *Limnophila* (*Dendrolimnophila*) *shikokuensis* sp. nov.; venation.
21. *Cladura* (*Cladura*) *serrimargo* sp. nov.; venation.
22. *Ormosia* (*Ormosia*) *remissa* sp. nov.; venation.
23. *Limnophila* (*Prionolabis*) *recurvans* sp. nov.; male hypopygium.
24. *Limnophila* (*Prionolabis*) *shikokuana* sp. nov.; male hypopygium.
25. *Limnophila* (*Dendrolimnophila*) *shikokuensis* sp. nov.; male hypopygium.
26. *Cladura* (*Cladura*) *serrimargo* sp. nov.; male hypopygium.
27. *Cladura* (*Cladura*) *decem-notata* Alexander; male hypopygium.
28. *Cladura* (*Cladura*) *taiwania* Alexander; male hypopygium.
29. *Ormosia* (*Ormosia*) *remissa* sp. nov.; male hypopygium.
30. *Molophilus* (*Molophilus*) *itoanus* sp. nov.; male hypopygium.

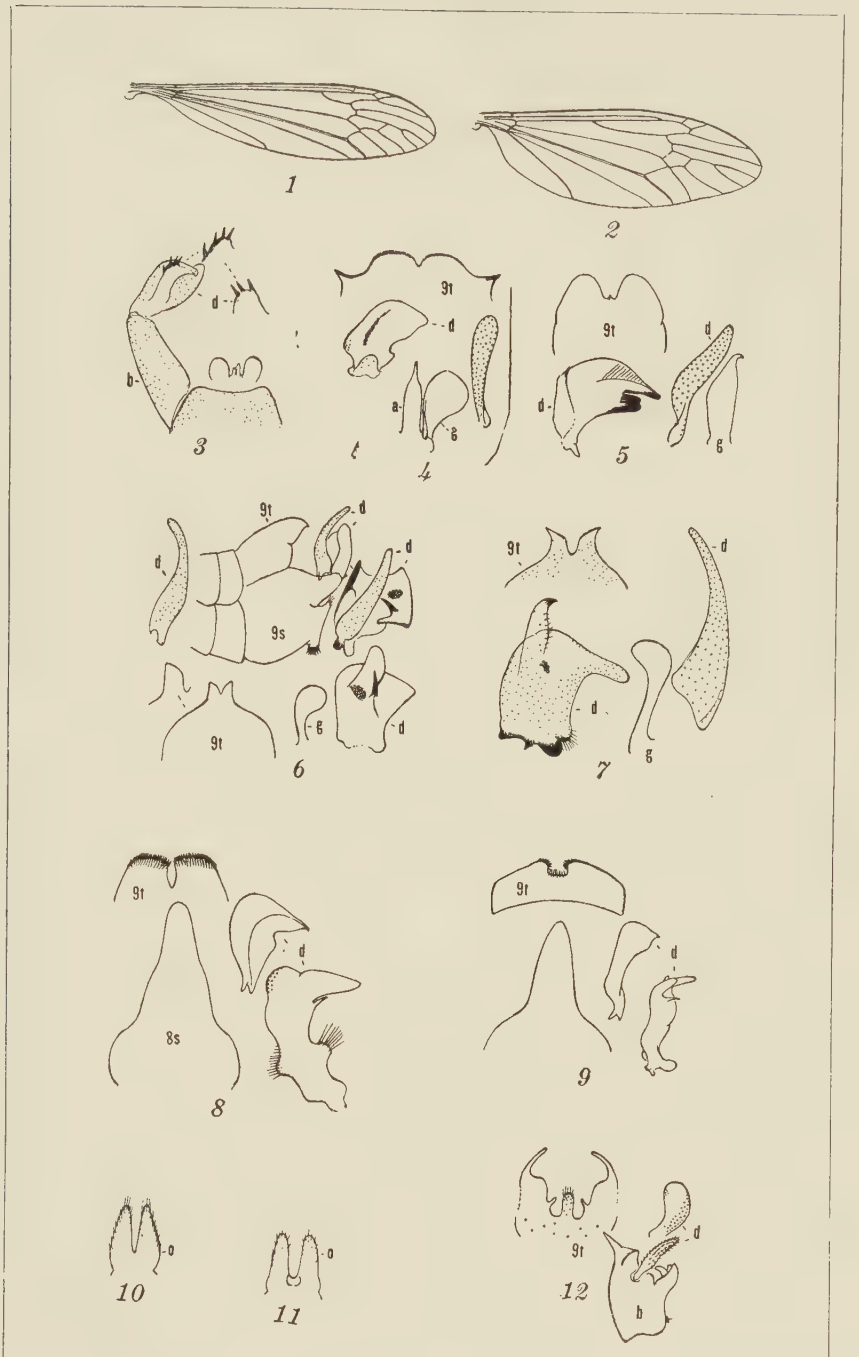
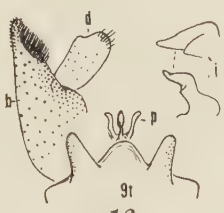
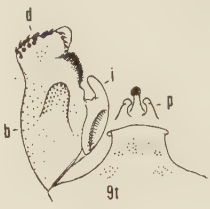

1
2
d
b
3
9t
d
a
g
4
9t
d
d
g
5
9t
d
9s
d
d
9t
g
6
9t
d
d
g
7
8s
8
9t
d
9
o
10
o
11
9t
d
h
12

PLATE 1.



13



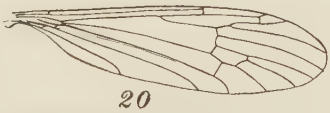
14

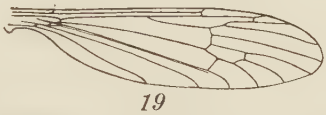
15

16

17

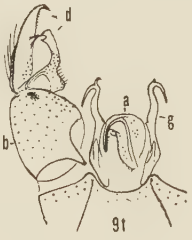
18


20

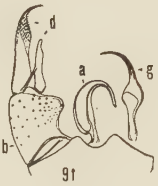

19

22

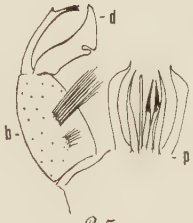
21



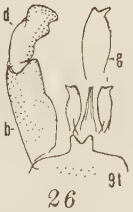
23



24

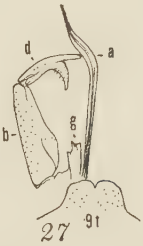


25

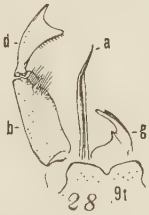


26

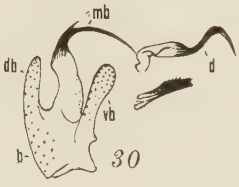
29



27



28



30

PLATE 2.

ISNEG BUILDINGS

By Morice Vanoverbergh
Bauco, Mountain Province, Philippines

FOUR PLATES

In the following pages I shall try to describe as accurately as possible both a typical Isneg[1] house or *balăy*[2] and a typical Isneg granary or *álaň*. To either of these descriptions I shall append a few notes on buildings that serve the same general purpose either of habitation and shelter or of storage, but are more or less different in construction. I shall conclude this paper with a relation of the Isneg customs that refer to the above topics.

THE ISNEG HOUSE

Here follows a detailed description of the house or *balăy* of a native of Abbil (Figs. 1 and 2). It is a fair representative of the ordinary Isneg dwellings that are found all over Apayaw.

The house is raised on posts, and consequently there is an open space underneath, where the only obstructions are the aforementioned posts: this open space is called *linóň* or *siduň*, and it is not high enough to allow a person to stand erect under the floor of the house.

The lower part of a post, which is buried in the ground, is usually left untouched; the rest is slightly whittled from below upwards (*magtaṿăt*), and, in the case of the six principal posts of the house (the *adíxi*), the surface is made as smooth as possible, so that the part of the post that is visible above ground, more especially what is inside the house, is round or almost so.

The posts are fifteen in number (Fig. 3), and all of them, except one, the *atobtóbo*, are mortised at the top (Fig. 4) for the reception of a beam: such mortises are called *sinăy*.

Eight of these posts, the *síńit*, do not reach higher than the floor, and usually very little time is spent in trimming them,

[1] The Isneg inhabit Apayaw, a subprovince of the Mountain Province, Luzon.

[2] Key to pronunciation: *a* as in bAr; *ā* the same, but long; *ă* as in cAt; *e* as in bEt; *ē* as AI in lAIr; *i* as in fIsh; *ī* as EA in dEAr; *o* as in cOt; *ō* as in Old; *ô* as in hOrse; *ô* the same, but long; *u* as in fÜll; *ū* as OO in gOOd; *x* as H in Horse.

as nothing of them is visible in the *sidág* or *unág* (inside of the house; outside: *lasí*).

Six of these *síñit,* three by three, are mortised into two girders or summers (*anadíxiyăn*), which support the floor joists. The other two *síñit* are mortised into the *agnádan* (or beams which support the walling) at the end of the annex (*tarákip*), as an ordinary Isneg house consists of two parts, without any intervening wall: the house proper and a small addition or annex at the left end (*kasixídān* or *sixídān*) of the house (Fig. 5).

The other seven posts are called *adíxi.* Six of them, three by three, are mortised into the two *ampákān* (or tiebeams that run lengthwise). Two of these *adíxi,* namely the central ones, are called *takilăy* and are a little taller than the four corner posts (a corner, not the post, is called *siyú-* or, sometimes, *síko*), so that their mortises or *sínăy* are correspondingly deeper.

The seventh *adíxi,* which also bears a special name (*atobtóbo, tobtóbo* or *anobtóbo*), is usually much more slender than the others and is situated outside (Figs. 2, 3, and 5), at the right end of the house. It supports one end of the ridgepole, but is not mortised at the top.

All bulky pieces of timber, whether posts or beams, are called by the general name of *dinampíg.* The edge at both ends of a piece of timber (whether a *dinampíg* or not) or bamboo is called *boñráw* (Figs. 6 and 7).

If a beam is somewhat longer than necessary, the Isneg rarely cut off the superfluous part; they usually leave it projecting into space. These odd parts, called *palońsawăy,* detract considerably from the elegance of the building.

In an Isneg house the floor is entirely independent from the *adíxi* or tall posts and from the upper part of the frame.

The two girders or summers (*añadíxiyăn*) into which are mortised the six *síñit,* or short posts, three *síñit* to one girder, are about one inch thick, and they run all under the floor lengthwise, supporting eleven floor joists or *toldóg* (Fig. 8). These *toldóg* (Fig. 9) vary in thickness between one and two inches; they are more or less boat-shaped and run crosswise over the two girders (*añadíxiyăn*), into which they are mortised.

Girders, floor joists, and, in general, all horizontal pieces of timber whose breadth is greater than their thickness, almost always stand on end in Isneg constructions.

Each of the eleven *toldóg* or floor joists is mortised at both ends: such a mortise (in this case: 1½ inches) is called *ammåd* (Fig. 9).

Over these eleven floor joists run two beams (parallel to the *añadíxiyån* or girders) that fit in their mortises or *ammåd* at both ends. These two beams, which are called *tápi*, project above the flooring inside the house and run lengthwise inside the *adíxi* or tall posts (Figs. 8 and 11).

These two *tápi* (Fig. 10) are mortised thrice. In the mortise of the end next to the annex, and in the mortise next to the post at the other end, are inserted two beams, also called *tápi*, that run breadthwise (Fig. 11): these latter *tápi* form the counterpart of the two *tápi* just mentioned, and they also project above the flooring, but, instead of running inside the *adíxi* or tall posts, they remain at the outside.

In the second of the two mortises at one end of the first-mentioned *tápi*, namely in the outer one, is fixed the first of the *agnádan* (sometimes called *agansadån*), a beam, 1′ x 2″, that supports the walling of the house at the end next to the *atobtóbo*-post (Figs. 10–11). This beam is 16′ 4″ long, which corresponds to the breadth (*sóba* or, sometimes, *pabbág*) of the house, at the outside.

This *agnádan* is mortised twice at both ends (Fig. 12) in order to receive the two tenons or *bóto* (Fig. 13) of the two corresponding beams, 1′ x 2″, which run lengthwise and support the walling at both sides of the house, in front and behind. These two beams, also called *agnádan*, are 24′ 2″ long, which corresponds to the length or *padúrot* (sometimes called *pásit*) of the house, at the outside, including the annex, which measures 3′ 11″ at the inside.

As they pass near the *adíxi* or tall posts, at the outside, these two last-mentioned *agnádan* are supported by thick wooden pegs or *páwat* (sometimes called *pálăy*, the same as in Iloko), stuck, one each, into the posts (Fig. 11). At the left end these same *agnádan* rest in the mortises of the *síñit* or short posts of the annex. Here they are mortised twice (Fig. 14) in order to receive the fourth *agnádan* (Figs. 11 and 15), which supports the walling of the annex.

This fourth *agnádan* (Fig. 15) rests upon the boat-shaped lower tenons of the two *agnádan* that run lengthwise, and is provided with two mortises, one at each end, in which are thrust the upper tenons or *bóto* of the same two *agnádan*.

As may be inferred from the above, the floor proper, 15′ 6″ x 10′ 6″, is surrounded on three sides (Fig. 11) by a narrow platform or *tamúyoń*, 1′ 1″ broad, that is projecting above the level of the floor. When the Isneg is sleeping or lying down, he rests on the floor with his head toward the wall, using the raised platform for a pillow, and his feet toward the center of the house.

The *tápi*-beam that runs breadthwise next to the annex, is usually much broader than the corresponding one at the other end, and, consequently, the floor of the annex is often considerably higher than that of the *tamúyoń*, or narrow platform that projects above the floor proper.

These are what we have at the height of the floor:

6 short posts (*síńit*) for the floor.
2 girders running lengthwise (*ańadixiyán*).
11 boat-shaped floor joists (*toldóg*).
2 beams running lengthwise (*tápi*).
2 beams (the one between the annex and the floor proper being higher or broader than the other) running breadthwise (*tápi*). These 4 *tápi* surround the floor proper on all sides and separate it from the raised platform (*tamúyoń*) and from the annex (*tarákip*).
1 beam running breadthwise at the right (*agnádan*).
2 short posts (*síńit*) for the annex.
2 beams running lengthwise (*agnádan*) and resting, at one end, on the two (*síńit*) of the annex.
1 beam running breadthwise at the left (*agnádan*).
These 4 *agnádan* support the walling all around the house, including the annex.

The upper surface of the four *agnádan* is provided with a rabbet or rebate (*taluńásiń*), which receives the walling (*dińdíń*), namely: the lower ends of the boards (*dabbí* or *dimbí*) which stand upright. These boards are merely juxtaposed, and their upper ends are received by the rabbet (*taluńásiń*) of the *axérān* or upper beams, that correspond to the *agnádan* below, and will be described in due time. In some districts, the upper rabbet is called *ammōronán*, in others, both rabbets are called by that name.

The outside of the wall is called *silíb* or, sometimes, *pa-bít*.

The height of the wall, which almost corresponds to the length of the boards, is 3′ 5″, and the boards, ½ inch thick, vary in breadth between 8″ and 1′ 7″.

Here and there one of the boards of the walling is missing or, rather, two boards are kept separated by a narrow open space: these openings constitute the windows or *lalamdáwan*

(sometimes called *sosoktán*), except, in front, at the extreme left of the house proper, next to the annex, where such an opening, generally larger than the others, constitutes the door or *xagíyáñān*. This door usually opens partly on the *tamúyoñ* or raised platform and partly on the floor of the annex. Access to it is gained by the ladder or *agdán*.

The windows are generally three, which correspond to the number of *saldá*—(section of a wall between two of the six *adíxi* or tall posts) less two: the *saldá*—with the door and the one next to which the hearth is situated. Occasionally a fourth window is allowed in the wall of the annex.

Exactly in the same way as the *síñit*, or short posts support, the *añadíxiyăn* or girders (three *síñit* to one *añadíxiyăn*), the *adíxi* or tall posts support the *ampákān* or tiebeams (three *adíxi* to one *ampákān*). Each *ampákān*, 1½′ x 9″, is mortised at both ends (as in Fig. 16, except that *a* and *b* are of the same breadth). These mortises receive the *sakkár* or tiebeams that run breadthwise, 1½′ x 9″, whose ends project beyond the *ampákān*. These *sakkár*, one at each end of the house proper, are also mortised at both ends, but here the mortises are much deeper than those of the *ampákān*, so that a simple tenon is left at the lower part (Fig. 16). A fifth tiebeam, also called *sakkár*, runs breadthwise over the center of the house proper, from one central post or *takilăy* to the other, and rests at both ends both on the *ampákān* or tiebeams that run lengthwise and on the top of the *takilăy*-posts. This third *sakkár* has neither mortise nor tenon.

Any place where one piece of timber supports another one without mortise or tenon, for instance, where the third *sakkár* (or fifth tiebeam) rests on the *ampákān*, is called *santăxān*.

Two other beams, 1′ x 2″, now come to rest into the mortise or rather upon the tenons (Fig. 16) of the two outer *sakkár* (not the central one, which has no mortise). Both these beams run lengthwise from one end of the house to the other, including the annex, and end in a tenon (Fig. 17). These are the *axĕrān*, and their lower surfaces are provided with a rabbet, in order to receive the upper end of the boards of the wall. Each of these *axĕrān* obtains a supplementary support from a peg that passes through it and is fixed in the central *adíxi* or *takilăy*-post, almost on a level with the central *sakkár*.

The tenons of these *axĕrān* (Fig. 17) are inserted into the mortises of the other *axĕrān* (Fig. 18) that run breadthwise and are also provided with a rabbet, in order to receive the

upper ends of the boards of the wall next to the *atobtóbo*-post and of the wall of the annex.

As the four *axĕrān* are less broad than the *sakkár* or tiebeams that run breadthwise, they remain almost on the same level as the latter.

These are what we have at the height of the tiebeams:

6 tall posts (*adíxi*): 4 corner posts and 2 *takilāy*.
2 tiebeams running lengthwise (*ampákān*).
3 tiebeams running breadthwise (*sakkár*).
2 beams running breadthwise (*axĕrān*).
2 beams running breadthwise (*axĕrān*).

The walls are limited by the *agnádan*, below, and by the *axĕrān*, above: their beams and boards get no support from any of the posts, whether *síñit* or *adíxi*, except indirectly through other pieces of timber.

The depth of the rabbet in the *axĕrān* or upper beam of the wall, considerably exceeds what is necessary for the reception of the upper end of the boards that constitute the walling: this is to allow the latter to be lifted up and taken out without difficulty, as they remain completely loose, being neither nailed nor tied to any part of the building. In this way, by taking out one or more boards of one or more of the walls, the house may look like an open balcony or a roofed platform.

Let us now consider the roof or *atáp* (*axa-pán* or *aga-pán:* place of the roof). Fourteen feet and four inches above the floor (*datág* or *xassarán*) proper is to be found the ridgepole or *talabáwan*, which consists in a narrow and comparatively thin beam, that rests with its broadest side (instead of standing on end) on two supports, namely: the *atobtóbo*-post, mentioned before, and the king-post (*pañtúd* or *patúna*). The upper ends of both these supports are slightly whittled and pierce the ridgepole.

The king-post rests on the fifth tiebeam or third *sakkár*, between the two central *adíxi*-posts or *takilāy:* it resembles a turned bedpost or leg of a table, and is cut out in a fanciful way up to two thirds of its height from beneath.

On either side of the king-post, there is a supplementary post (Fig. 19), a kind of queen-post, also called *pañtúd*, that rests on the same *sakkár* or tiebeam and reaches the central purlin (one out of three). Both these queen-posts consist in a small board which faces the king-post. They are notched very elaborately (Figs. 19 and 20), although not quite regularly, all along the edges on both sides.

A similar queen-post (a single one) rests on the outer *sakkár* or tiebeam that runs breadthwise, next to the *atobtóbo*-post: it is situated between this post and the front of the house, and has no equivalent at the other side (Fig. 22).

Across the king-post run three pieces of timber (*sókar*), a kind of straining pieces, one above the other: their ends reach the three purlins of the roof on either side. They run parallel to the third *sakkár* or central tiebeam that runs breadthwise, but only the two lower ones come in contact with the queen-posts (Fig. 21).

A similar combination of straining pieces or *sókar* runs above and parallel to the outer *sakkár* or tiebeam that runs breadthwise next to the *atobtóbo*-post (Fig. 22).

Both sets of straining pieces or *sókar* consist of small beams, except the upper *sókar* of the outer truss (Fig. 22, *c*), which is simply a round stick.

The upper *sókar* of the central truss (Fig. 21, *c*) merely touches the king-post, while the central one (*d*) is perforated by the king-post and the lower one (*e*) pierces the king-post.

The queen-posts (two in the central truss and one in the outer truss) are pierced by the lower *sókar* (Figs. 21 and 22, *e*).

The central *sókar* of the central truss (Fig. 21, *d*), which is perforated by the king-post, is very peculiar. It consists in a rather bulky piece of timber, whose central part, which corresponds to one-third of its length, is much broader than the rest; the two remaining parts, one at each end, taper off until they reach the purlins, where their breadth is diminished by about one-half. Both lateral surfaces are ornamented with carved lines: one crooked line alternates with three consecutive straight ones, both the line next to the king-post and the last line of the series being crooked ones in either direction (Fig. 23).

The rafters, about 3″ broad, are of two kinds: fifteen *tadáwag* or thin pliable boards and seventeen *badây* or solid rattan stems, at either side of the roof. At one end they rest on the ridgepole, and at the other end they join the *axĕrān* or upper beam of the wall. The central *tadáwag* or wooden rafter is situated above the central tiebeam or third *sakkár* and is a little broader than the others. Between each *tadáwag* or wooden rafter there is a space of about 11 inches, the center of which is occupied by one of the *badây* or rattan rafters: consequently the latter alternate with the *tadáwag*. The last rafter at both ends, next to the annex and at the

opposite end, is a rattan one or *badăy,* and a supplementary rattan rafter (*badăy*) is situated between the walling of the gable and the edge of the roof, in front of the *atobtóbo-* post: this supplementary rafter is not visible inside the house.

Each rafter rests on three purlins or *írāt,* that run all along the roof, between the ridgepole and the *axĕrān* or upper beam of the wall, all these pieces being at about the same distance from one another.

The two outer purlins or *írāt* consist in a thin narrow beam, while the central one, also called *alásip,* is much thicker and irregularly hexagonal: one of its sides, by far the largest, faces the rafters, and the other five are visible inside the house (Fig. 24).

All purlins end in a tenon (Fig. 25), which protrudes outside, after it has passed through a mortise practised in the *pa-gĕr* or board that runs all along the roof, outside the gable, and that will be described presently.

In some houses, there are four purlins, all of the same size: these are called *palăn.*

Canes of bamboo grass (*bassáw, Miscanthus sinensis* Andr.) are tied crosswise over the rafters: they are close together and form the *rárat,* a kind of ceiling that prevents the thatch from being visible inside the house. Over this covering of canes or *rárat* is placed a large amount of layers (*adĕ-;* one layer: *tañadĕ-*) of cogon grass, which form the real roofing and cover everything, the ridge (*boboń;* ridging; *bobońăn* included. Even the two ends of the ridgepole or *talabáwan* are completely hidden under the cogon grass of the ridge. Either end of the ridgepole together with its covering of thatch is called *păyoń-ó,* and the upper corner of the gable, namely the opening under the *păyoń-ó* through which the smoke escapes, is called *tabúñān.*

The *dubá* or gable (*agduhaăn:* place of the gable), at the end of the house opposite to the annex, is ogival in form, partly open and partly covered (Figs. 2 and 25). All along the border of the gable we find the *pa-gĕr,* which consists of thick boards that run from the lower edge of the *axĕrān* (upper beams of the wall) up to the ridgepole.

This *pa-gĕr* is provided on each side with four or five mortises, through which project four or five corresponding tenons; besides, it is cut out twice on both sides, in order to give room to corresponding beams. The lowest tenon on either side

belongs to the *axĕrān* (upper beam of the wall) that runs lengthwise: this tenon (Fig. 17) passes first through the *axĕrān* that runs breadthwise (Fig. 18) and then through the *pá-ger;* after which the lower end of the outside *badăy* or rattan rafter is attached to it. The other three or four tenons, on both sides, belong to the corresponding purlins. The parts of the *pá-ger* that are cut out, are filled up with the ends of two beams that keep in place the walling of the gable and correspond in every detail to the *agnádan* (lower beam) and the *axĕrān* (upper beam) of the house wall: here, however, they are both called *axĕrān.*

The space between these two beams or *axĕrān* of the gable is filled up with boards that are arranged in the same way as those of the walling of the house. The space between the upper beam and the top of the gable is left open.

The *atobtóbo*-post, which supports the end of the ridgepole at the gable, remains outside the house from the ground up to the lower edge of the lower *axĕrān* of the gable (Figs. 2 and 25). At this point it enters the house and remains invisible at the outside, until it reaches the open space between the upper *axĕrān* of the gable and the apex of the *pa-gĕr.* Consequently the walling of the gable end of the house is situated inside the *atobtóbo*-post, while the falling of the gable is situated outside.

At the opposite end of the house (Fig. 1), the annex is covered with a lean-to roof, and the only part of the gable that projects above it is the one that corresponds to the open space or *tabúńńān* of the complete gable next to the *atobtóbo-post.* Here, however, it is not open, but covered with cogon grass, which is pressed between a close set of canes of bamboo grass, at the inside, and a frame made of the same material, at the outside. This frame (Fig. 26) consists of a certain amount of canes placed in a slanting position and crossing one another, one by one, with plenty of space between, and of two pairs of canes that run horizontally across the former.

The rafters of the lean-to roof rest on three purlins and on the *axĕrān* (upper beam of the wall) of the annex. These purlins correspond to those of the house proper, and are similar to them, except the central one which is much thicker in the middle than on either side (Fig. 27) and whose free rounded surface is profusely carved (Fig. 28).

On both sides of the annex the principal roof is continued until it reaches the lean-to roof. Two small beams serve for

purlins: they correspond to the two lower purlins of the principal roof.

Single thick boards run in a continuous series, the *baládag*, all around the house, under the eaves (*aribáyan* or *ribáyan*), except of course at the gable end, on the right, next to the *atobtóbo*-post, where we have the *pa-gĕr*. The inner surface of these boards is applied to the projecting part of the roof, outside the walls, and their upper side touches three of the *axĕrān* or upper beams of the wall, namely: the two that run lengthwise and the *axĕrān* of the annex that runs breadthwise. Where the ends of these boards meet, they are merely juxtaposed, not jointed.

Let us now come down to the floor (*datág* or *xassarán*).

All across the eleven boat-shaped floor joists (*toldóg*) are placed thirty-one *talaxátag*, laths of wood or of palma brava (*ballán*), 2″ broad by a little over 1″ thick, at a distance of about 2 inches from one another. Over these *talaxátag* is spread a kind of mat, which is made either from solid rattan (*uwáy*) stems or, more commonly, from canes of bamboo grass, tied together by means of strips of rattan (*takád;* ties that are not used for flooring are called *xálut*). This mat, the real *datág* or *xassarán*, remains free throughout and can be lifted up at will, e.g. when the inmates want to expectorate, etc.; most of the dirt, however, falls through the interstices, and there is no necessity of removing the mat. Besides, in the generality of Isneg houses, the *datág* consists of several sections, which are independent from one another and can be removed separately.

The same arrangement of laths and matting is to be found on the *tamúyoń* or raised platform that surrounds the floor proper on three sides. Here, however, the *talaxátag*-laths are much more elaborate, their lower surface being raised in the middle into a kind of knob (Fig. 29), and they are about 7 inches distant from one another; at one end they are laid down in little mortises cut into the *tápi*-beams (Fig. 30), and at the other end they are stuck into the *agnádan* or lower beam of the wall.

Next to an *adíxi* or tall post, the matting of the *tamúyoń* is replaced by a little board, called *baládag* (like the boards under the eaves); each of these boards is cut out circularly on the side that meets the post in question (Fig. 31). A single entire *baládag* is placed over the *tamúyoń* in front of the *atobtóbo*-post. This one has not to be cut as no post interferes; but a second small rectangular board connects it with the *atobtóbo*-post: this latter board is situated at a slightly higher level than

the first one, and it is pierced at one end by the *atobtóbo*-post itself (Fig. 32).

The *pad-óñ* or floor of the annex is similar to that of the main floor. Here the ordinary *talaxátag*-laths rest at one end in mortises cut into the projecting part of the *agnádan*-beam that supports the walling of the annex (Figs. 33 and 34), and at the other end in little mortises cut into the *tápi*-beam (Fig. 30).

Any part of the floor where the matting is lacking and, consequently, where the *talaxátag*-laths are plainly visible, is called *sali-ñiñăt*.

The part of the main floor which is situated next to the post that faces the door, is reserved for the hearth or *dapúg;* the latter is square and is surrounded by four small beams (*dalipáñ* or *puxáro*). The hearth proper consists of layers of leaves (of the banana or of zinziberaceous plants) covered with sand or clay, in the center of which three stones (*taxăñ*) are fixed in such a way as to be able to support cooking utensils.

Fuel is stored somewhere on the floor next to the hearth; the place where it is kept is called *agsidílān*.

A three-storied platform is suspended over the hearth. Its lower story is called *agsapanăn* or *palasân*, and consists of two (sometimes four, forming a square) horizontal sticks, which are suspended from the second story by strips of rattan: it is used for storing fuel that is not yet completely dry and, occasionally, meat of the wild boar. The second story is the *páxa*, and consists of laths of wood, slivers of bamboo or canes of bamboo grass, usually woven into a compact whole by means of strips of rattan: it is used for storing *assúp* (bundles of rice that have to be dried before they are pounded; fuel, rice, etc. which have been dried over the fire, are called *insupăn*). The third and upper story is the *paratăg:* it is the strongest of the three, is made of wood, and is used for storing calabashes of rice, baskets, etc.

The part of the ceiling that is situated immediately over the hearth is the *sisilúxān* (from *sílug*, soot).

A couple of shelves are most generally attached to the wall, somewhere near the place of the hearth, at a certain height above the floor:

The *agamotowân:* usually a board, sometimes open-worked woven bamboo, on which are placed the *amotó*-jars used for keeping drinking water, and an occasional *báña*-jar used for cooking rice.

The *arañăt* a shelf of open-worked woven bamboo slivers, on which are placed bowls, plates, etc.

Besides these, there may be found an *ăyúd,* a square piece of woven bamboo or rattan, which dangles from four rattan strips that meet above and are attached somewhere to the ceiling: it is used chiefly for storing *báña*-jars.

The Isneg ladder is generally very narrow and consists of two side pieces of bamboo, with short sections of bamboo for rungs (*pákad*) : the latter are stuck in holes (*agabbó;* a general term for holes or mortises cut into wood or bamboo) cut into the side pieces, and are usually rather far apart.

The door (*xitáp* or *xisád*) mostly consists of two valves (rarely one) : two single boards turning upon pivots on the opposite side of the opening, the pivots revolving in mortises cut into the corresponding house beams. But there are many varieties of Isneg doors, all of which agree in one characteristic: clumsiness.

PECULIARITIES

In a few Isneg houses the annex is superseded by a separate building, which contains the hearth and serves for a kitchen. In this case the doors of both house and kitchen face one another and a board connects the two, while the ladder is placed against this board.

At Bayag, a good many houses are provided with a separate kitchen, and the ladder sometimes rests against a platform (*bańsăl*) which connects both buildings.

There also the windows are often square and cut out of the walling, in which case there is a *pasańgír* or upright that reaches the upper beam of the wall, on either side of the window, and the shutters or *xitáp* slide over a beam (*baxákat*) that runs all around the walling, at the outside. These *pasańgír* and *baxákat* are often carved very elaborately (Figs. 35–37).

In some rare cases the house is divided into separate rooms by one or more *baát* or partitions.

Occasionally a little shed or a lean-to, where the Isneg pound their rice, is attached to some part of the house. This floorless annex is called *baláwa* (sometimes *batalăn*), and the place itself *agaaltóñān* (*altóñ:* mortar) or *agbabăyowăn* (*magbăyo:* to pound rice). Next to the mortar one usually sees a large stone (*babatăyān;* this is also the name of the stone that is sometimes placed at the foot of the ladder to keep the latter from sliding) on which the smaller girls stand (*magbatăy*) in order to reach the former. Sometimes the *baláwa* is a separate shed that has no connection with the house.

In some houses a small lean-to projects from the gable side of the house: it is called *talâb* and is used by the Isneg for storing their belongings.

A lean-to that is erected to prevent a ruinous house from breaking down is called *galíad.*

When the *agnádan*-beam sags down under the weight of the walling which it supports, a supplementary post (*pakébăy*) is placed under it, in order to keep it up.

All over Apayaw much use is made of props in order to keep ruinous buildings from leaning sideways: these props, which consist in heavy bamboos or pieces of timber, are called *túxăy, tu-găy* or *tugkál.*

In a few houses the foot of the ladder, instead of touching the ground, rests upon a small platform or *balansâg,* which can be stepped upon directly from the ground.

When the pieces of lumber that are available, are not large enough for a definite purpose, two pieces may be jointed into a post, etc.; such a joint is called *agsulpítān,* and the finished piece *sinulpít.*

Dove-tail joints are called *ormá.*

At Bayag, a very few houses have a flooring of wooden boards.

If the flooring consists of slivers of bamboo, instead of a matting of rattan (or canes of bamboo grass), it is called *dala-dât.*

The *pisó* or *taddó* is a matting that consists of close-woven slivers of light bamboo, whether twilled or checker: it may be used for walling and for flooring. A good many Isneg houses, however, have thick strips of heavy bamboo for the walling: these strips are tied horizontally one above the other and the space between them is amply sufficient to supply the need of windows.

In Musimut I have seen houses whose windows were mere holes cut out of one or more of the boards of the walling: they were mostly heart-shaped or nearly so.

In some rare cases, the walls of the house are painted blue at the outside, by crushing fruits of the *atiyóti* against them. The *atiyóti* is a forest tree with large leaves and red flowers.

Instead of cogon grass, the roofing may consist of palm leaves (*lañpá*), of leafed canes of *síal* or bamboo grass (*bassáw;* such materials, when ready for use, are called *añpât*), of nipa leaves or *tatá* (*Nipa fructicans* Wurmb.; rarely), or of stems of light bamboo (*bólo, Schizostachyum mucronatum* Mack.) cut

into halves and kept together by means of canes of bamboo grass, which are called *radát* in this case. Three or more rows of entire bamboos are usually tied over these kinds of roofing, at about equal distance from one another, between the ridge and the eaves. These bamboos, called *arsít*, prevent the roofing from disintegrating and from being blown away by the wind. In any case the ridging consists of cogon grass, and at least three rows of slivers of bamboo (*darpít* or *arpít*) are tied over the ridging, on either side.

The frame of the house, as yet devoid of roofing and walling, is called *ñasñassår*.

The ordinary type of house, in which everything is made of timber, except the flooring and the roofing, is called *binúron*. But there is another type of house, that is very often met with in plantations, where it serves for a temporary residence, when the family has left the village to look after fields and gardens.

The frame of this kind of house consists mostly of rough pieces of timber and bamboo. Its posts, its tiebeams, its girders and joists, its floor, its rafters, and its purlins are disposed in the same way as those of the generality of Philippine houses.

The walling usually consists of thick strips of bamboo: it is identical with the occasional walling in the village type of house, which has been mentioned before.

The roofing also is the same, except that in the village type of house it is usually much thicker.

In short, the whole appearance of this lighter type of house shows very clearly that comparatively little care has been bestowed on its erection and that it is destined only for a temporary residence. It is almost superfluous to add that, every year, such houses are in need of a good amount of repairs, and that, in many cases, one year is the limit of their usefulness.

The roof (of the gable type) and the floor, however, deserve special mention, mostly on account of the terms that are used to designate their component parts.

The flooring often consists of entire bamboos tied together by means of strips of rattan: such a floor is called *básag*. Besides the beams that run all around the house and on which rest the floor joists, there is usually a grinder (*tólug*) that supports the same joists at their center. It is also very common to find supplementary short posts scattered here and there under the floor, where they support the weakest parts of the building. Such posts, which generally consist in sections of heavy bamboo, are called *túkid*.

The rafters consist either of pieces of timber or of entire light bamboos; the latter are perforated at the upper end where they are strung on a stick (*ásip*) that is situated very near the ridgepole. These rafters, called *parbó*, rest on the ridgepole, on three or more purlins (the large ones: *babákan* or *ambabákan;* the small ones: *agaptán*) and on the tiebeam. The roofing is placed immediately over the rafters and it is plainly visible inside the house, which is not the case with the ordinary type of house in the village.

The *síxăy* or hut of the rice field has been described in my paper on Isneg farming. (Cf. Publications of the Catholic Anthropological Conference, Vol. III, No. 4, The Isneg Farmer, Washington, D.C., 1941.)

The *báwi* is a floorless hut made of sticks, canes and leaves or grass: travellers, etc. erect it as a temporary shelter for passing the night.

Blacksmiths use a *báwi* or shed (*babtalán,* from *battál:* forging) that consists of a roof supported by a few posts.

Young pigs that have been brought in from outside, are sometimes kept in small pens, until they are thoroughly domesticated. Such pigsties (*dóxoń*), which are usually square or almost so, consist of a few entire bamboos, that are used for posts and make up the walls and the floor: they are ordinarily roofless.

Jars of *básІ* (an alcoholic beverage obtained from the juice of the sugar cane) are often partly buried in the ground, at some distance from the house, in which case they are usually protected by a shed (*agabolúxān*) that consists of four posts and a rudimentary roof.

THE ISNEG GRANARY

Here follows the detailed description of one of the granaries that are to be found at Musimut. All Isneg granaries (*álań*) are very much alike: when you have seen one of them, you have seen them all (Figs. 38 and 39).

The ground plan of the Isneg granary is a rectangle, with a short post or *síńit* at each corner.

Each post (*síńit*) is thinned both in the middle and at the top; the latter part is provided with a mortise and immediately surmounts the *uppó* or *lappó,* which juts out very considerably (Fig. 40). The height of a *síńit,* excluding the slender mortised part, is 3 feet and 8 inches.

Two beams (*batáñān;* Fig. 41), twice mortised at the upper side and 5 feet and 9½ inches long by 8½ inches broad, rest in the mortises of the posts and connect them, two by two, running lengthwise.

Two similar beams (also called *baťáñān;* Fig. 42), twice mortised at the lower side and 4 feet and 8 inches long by 8½ inches broad, connect the former two, running breadthwise.

The four *batáñān* are jointed at their mortises and remain on the same level throughout.

A large round board, 2 feet and 4 inches in diameter, provided with a hole in the middle, is slipped over the mortised top of each post and rests on the *uppó* of the latter, immediately under the *batáñān.* The four boards, called *alĕdiń* or *andíliń,* keep rats and mice from climbing into the granary (Fig. 43).

Four beams (*talákub*), not visible outside, connect the *batáñān,* at the height of the floor, with the tiebeams, at the eaves. These four *talákub,* which are mere prolongations of the posts, slant outward, in front and at the back, so that the granary is broader at the eaves than at the floor (below: about 4 feet; above: about 5 feet; cf. Fig. 47).

Two tiebeams (*agpåt, adpåt, agpår* or *adpår;* Fig. 44), twice mortised at the upper side and 5 feet and 9 inches long by 6½ inches broad, run lengthwise, each connecting two *talákub* with one another.

A few sticks (*saxudsúd*), not visible outside, are placed upright in slanting position, in front and at the back, between the *talákub* or prolongations of the posts. These *saxudsúd* run from the *batáñān,* at the height of the floor, up to the *adpår* or tiebeams that run lengthwise, and serve as supports for the walling, in front and at the back.

The place of the tiebeams that should run breadthwise, is taken by the *pálut* or *páwiń,* which run up all along the edges of the gables, and follow their outline (Fig. 45). There are two *pálut* at either end of the granary, and they do not meet on top, as the end of the ridgepole intervenes between them. At their lower end they are either mortised or provided with two tenons: here they are connected with the two *adpår* or tiebeams that run lengthwise, at the latter's mortises. These four *pálut* or *páwiń* are visible outside, but there are also four corresponding pieces of timber, called *togkár,* at the inside, so that the walling of the gable is pressed between the *pálut,* at the outside, and the *togkár,* at the inside.

Braces in the roof are also called *togkár.* These braces connect some part of the ridgepole with the end of a tiebeam,

and run under the rafters. They are usual in granaries, but very rare in houses.

The general outline of an Isneg granary is very peculiar, as may be seen in Figs. 46 and 47. The gable ends are called *tampaníki;* the front and the back, *tambabăy.* The length of a granary, from gable to gable, is called its *patalkúb.*

The walling usually consists of *pisó* (or *taddó*), plaited slivers of bamboo. At the gable ends this walling runs up uninterruptedly from the floor to the ridgepole or apex of the gable. Granaries that have a walling of boards (*dabbí*), are called *dimbí.*

Four boards, some 6 inches broad, cover the lower edges of the walling, at the outside, immediately above the *batáñān* beams. These boards, called *baxákat* (literally: belt), run around the whole granary.

In the same way as the *pálut* cover the edges of the walling of the *tampaníki* or gable ends, at both sides, so also four ordinary boards cover the edges of the walling of the *tambabăy:* these boards, which run from the *baxákat* to the *adpăr* or tiebeam, are called *talákub* (like the prolongations of the posts, at the inside).

From the upper edge of the *baxákat* to the tiebeam, at the eaves, in front and at the back, the wall measures 2 feet and 8 inches. The distance from the ridgepole to the ground is 11 feet and 10 inches. The ridgepole is 11 inches long.

All Isneg granaries are thatched and the materials are the same as those used in thatched houses. The frame of the roof is similar to the one that covers the less elaborate type of Isneg house, which is erected in plantations and in which the rafters are *parbó;* the purlins of the granary, however, are called *páñal,* not *babákan.*

As in the case of a typical Isneg house, a board runs along the eaves, underneath, next to the *adpăr* or tiebeams: here, however, it is absent at both gable ends and it is called *patalkĕb,* not *baládag.*

The flooring consists of *básag* (strips of palma brava), which rests on the *toldóg* or floor joists. The *toldóg* of an Isneg granary are nothing else but entire bamboos.

A square opening that serves for door (*xagiyáñān* or *lalankăn*), is cut out of the front wall, in the center. Two pieces of timber (*aga-dálān*), which are curved (convex side outward), run from the *baxákat* up to the *adpăr* or tiebeam, on

either side of the opening. Two horizontal pieces of timber complete the square: the lower of the two is called *dadamkăn* (literally: place whereon one treads; Figs. 48 and 49). Just below the *dadamkăn* or doorsill, a board, 7 inches broad, is fixed between the *batáñān* and the *baxákat;* this board, which is called *agansadăn,* projects outwards and serves for a kind of shelf, on which are placed the bundles of rice that are being extracted from the granary, before they are brought down to the ground.

The shutter is a square board with a perforateted knob in the middle. To close the granary, a wooden bar is thrust through the holes of the two *aga-dálān* and of the door knob.

The two *aga-dálān* and the four *pálut* (at the gables) are sometimes ornamented with carvings.

Temporary granaries are called *sipí:* they are very light structures and have the shape of a cube raised on posts, with a lean-to roof. Instead of an *alĕdiñ* or round board, a section of a palm tree, called *líbañ,* is stuck on the top of each post, under the *batáñān,* in order to keep out the rats. These *líbañ* are very similar in appearance to the *uppó* of the common granary posts.

ISNEG CUSTOMS

When the Isneg wants to build a house or a granary (*mag-pa-dá-:* to erect a building; *magbalăy:* to build a house), the first thing he has to do is to go and observe the flight of the *labág*-bird for a favorable omen, after which he starts gathering materials (*magtarikăyo*).

There are a few kinds of timber that are absolutely tabooed, among others:

The *balañá,* a tree whose leaves resemble those of the Java plum. Should *balañá*-timber be used in the construction of the house, some kind of sickness will inevitably affect one or more of its inmates; the disease will come on quite suddenly, without any apparent cause, and culminate in death.

The *bátug,* a tree whose timber is not much esteemed. If it were used for a post, it would cause the death of the owner of the house.

Any kind of tree that is *maalasíāt,* covered with clustering vines.

The next thing that has to be done is to pull these materials out of the forest (*maxalud-úd*), and to bring them to the place where the building will be erected.

Auguring has again to be resorted to before the erection of the posts.

On the day that has been set aside for the purpose, after a previous consultation with neighbors and friends of the family,

a group of men come together at the place where the materials have been assembled. Here they select four beams and place them on the ground in the form of a rectangle, with a piece of ginger and some *taxaligdá* (small herbs that grow in the forest), for amulets, in the center: this ceremony is called *magsáñal.* After that they dig the holes, erect the six tall posts or *adíxi* and, if time permits, fix the two *ampákān* or tiebeams that run lengthwise. No more work is performed that day, and the next day absolutely nothing is done; this cessation of labor for an entire day is called *maxalaláw* (*maxalalláw* at Bolo).

On the third day, the work is taken up again, and it is not discontinued any more, except, of course, when there is a lack of materials or men, which is far from unusual.

At the construction of the roof, the Isneg make use of a kind of primitive scaffold (*patapáya*), which consists of a few bamboos that rest on the frame of the house: it is taken down as soon as the work is finished.

Should a rainbow (*buñlún*) happen to surround a house under construction, this means death to the owner of the house in the near future: he will be *mabuñlúnān.*

Shoud a swarm of bees (*xáwan*) be flying over it, the effect is equally disastrous.

At Bayag, when a new house is being erected, somebody has to throw a few kernels of rice all around, and more especially on the path that leads up to it. At the same time the following prayer is recited (text obtained from *Pokól,* a Bayag man):

Ne ma- bisín ta magadăyyóa. Here, hunger, so that you go away

The gutter for leading off the water that drops from the eaves, is called *alináwañ* or *láwañ.* The house yard is called *amuwág,* when it is considered in itself, and *lasí* (outside), when it is considered in relation to the house. The surrounding grounds, usually covered with weeds and bushes, are called *lu-mó.*

The erection of a granary is conducted in the same way, mutatis mutandis, as that of the house. The only noteworthy exception is the use of the *báwig,* which consists in a strip of rattan that is attached at one end to the top of one of the *tampaníki* or projecting gables, and, at the other end, somewhere in the ground, at some distance from the granary in question; this is done in order to make sure that the building stands straight.

At Dangla I noted down a couple of Isneg tales that had to do with the building of houses.

In one of them it is told that two brothers, having gone to the forest to gather timber for their new house, started to cut down one of the pine trees (*tálañ*), which seemed to suit their purpose very well, when all at once the spirit *Mañmañkít* interrupted them by shouting: "This is my house."

Another story relates the adventures of *Manírām*, who, whenever he built himself a new house, invariably burnt it down again. After he had done this several times in succession, it happened one day that he was caught in the burning house and died in consequence.

When everything is in readiness and the Isneg goes to occupy his new home, he must offer a sacrifice to the spirits (*maxumé-:* literally, to enter) as soon as possible, lest one of his children die. He is allowed to choose between the *săy-ám* (the more solemn sacrifice) and the *pildāp* (called *paglañkán* in this case), except if his new house is a *binúron* (with walling of timber), in which case he is obliged to offer the *săy-ám*-sacrifice, and, before entering the house, he must promise to do so.

At this particular *săy-ám*, the owner of the house himself picks out the first dancer, the *magpatalíp*, who must be a brave man, as he is not allowed to begin the performance before he has extolled his former exploits (*magpakkáw*). As a reward for his services, the *magpatalíp* receives from the owner of the house one piece of cloth (any kind) and two bracelets, which consist in a mere string provided with one single bead. Before he dances, he is required to put on the two bracelets, but not the cloth.

The following prayers are of use, while either of these sacrifices is going on:

1. During the *maxaníto* (a shaman's communication with the spirits), when *inapúxān* (betel for chewing) is offered at the edge of the yard, which has been cleaned for the purpose. Text furnished by Uwíl from Bolo:

Nénu ma- pe ibañńán ya inapúxān ta dínu ma- pe dam-án ya pandá năyá inaxédān.

Here for you, inhabitants of this place, the betel (for chewing), so that you do not step over the limit of what has been swept.

2. At the offering of *inapúxān* to the ancestors. My informant, Bǎydán from Tawít:

Iápugko iáw bumagtó na talló wa ólo ta umădayyóka.	I offer betel (for chewing) to you, three-headed Bumagto, so that you go away.
Iápugko iáw éñig ta anáyonta akkán.	I offer betel (for chewing) to you, Engig, because we are relatives, not?
Iápugko iáw malindáw ta taxasinnánnaami.	I offer betel (for chewing) to you, Malindaw, so that you look after us.

3. While rice is being thrown away. The same ceremony with the identical prayer, is performed at the agony of a dying person. This and the three following texts were given me by Pokól from Bayag:

Ne ma- nabláñ aníto ta akkámmo patăyán daamí.	Here, murdering spirit, so that you do not kill us.

4. While rice, a leaf of the betel pepper and a piece of betel nut (no lime) are being thrown away:

Ne ma- sinakít ta mapánka adăyyó.	Here, Sinakit, so that you go far away.

5. While rice, a leaf of the betel pepper and a piece of betel nut (no lime) are being buried in the ground, under the house. This is an offer to *Añká*, a spirit who is supposed to talk under the house at night:

Ne ma- añká ta maganani-gádka.	Here, Angka, so that you go down (enter the earth).

6. While rice is being placed in the corner of the hearth and covered with ashes:

Ne ma- battúg ta maggigânka i dapůg.	Here, Battug, so that you dwell at the hearth.

Battúg (literally: riches) is a benevolent spirit whose help is much appreciated by the Isneg. They possess an amulet, called *addát batbattúg* (literally: grass of riches), a small herb with a comparatively bulky root, that brings plenty to the man who plants it in his rice field, in his garden, near his house, etc. Then there is the *abulbulón batbattúg* (literally: companion of riches), about whom the following story is related by the Isneg:

> One night a man dreamed that he saw somebody carrying a huge bunch of bananas; the next morning his dream came true. Another night he dreamed that he met a man with a large bundle of rice, and again the dream came true. He always met the man (the *abulbulón batbattúg*) he had dreamed about, late in the morning, but they never talked. The dreamer became very rich and he recounted his experiences to any willing listener. That is the reason why the Isneg refuse to set out early in the morning and mock at those who do.

An amulet that is very powerful in new houses, is the *asipûg*, a small herb with obovate serrate leaves, which grows on rocks and stones.

If a *labág*-bird (augural) passes under (*magsilpút*) a house that was occupied only a short time ago, or if one of its posts is invaded (*mabalaxúbug*) by white ants, this means that one of the inmates will die as the Isneg generally bury their dead under the house. To prevent such a catastrophe, the family must leave that house, and move elsewhere, not, however, before the flight of the *labág*-bird has been observed.

An abandoned house is called *baáw*. If many of its former inmates have died there, nobody is allowed to use any of its materials, not even for fuel: it is simply left to rot.

The most important guardians of the house are the *Pílăy*-spirits and *Dadamkân*. The former, who reside at the inner corner of the hearth, (next to the post of the house), on the *páxa*-shelf over the hearth and in the granary, have been treated at length in my paper about Isneg farming (cf. op. cit.). No sweets are prepared in the house without the *Pílăy* having their share: a saucer containing a part of the sweets, is invariably placed on the *páxa*-shelf. Nobody is allowed to touch another man's granary under penalty of becoming lame (*pílăy*); whenever a *Pílăy*-spirit touches a man, lameness is the result.

Dadamkân takes the threshold under his special protection. Anybody who steps on the doorsill or threshold, when entering or leaving a house, is punished with sickness and dies a certain death. The following prayers are addressed to that powerful spirit:

While offering sweets, which is compulsory whenever the latter are prepared by the inmates of the house. Text obtained from Umilá, an Abbil man:

Ne ma- uwámo dadam-án ta dínaami ad-adanniyán. — Here, this is yours, Dadamkan, so that you do not approach us.

While offering *inapúxān* (betel for chewing). The text of the first prayer was given me by Lampá from Dangla. The second prayer, obtained from *Bǎydán*, a Tawit man, is very old and addresses *Dadamkǎn* under the name of *Gallál:*

Iápugko ikáw dadam-án ta uwaámmo melab-áń kadakamí ya isagaddán. — I offer betel (for chewing) to you, Dadamkan, so that you guard us mortals from being killed.

Iápugko ikáw gallál ta dinapaggallagallalán. — I offer betel (for chewing) to you, Gallal, so that you do not open your mouth over me.

Other household spirits are:

Panaránān, who keeps company with the *Pílǎy*, at the corner of the hearth.

Xabáwān, a female spirit, and *Sǎkit*, who stay at the place where the *tońtoń* (bamboo tubes used ceremonially during *sǎg-ám*-sacrifices) are kept in store.

Inulnǎy, who stays somewhere in each Isneg house, often at the place of the *tońtóń*. Whenever the inmates of the house partake of much steamed viands, they have to give *Inulnǎy* his share.

Túbal, who guards the family at night, but repairs to his own abode in the daytime.

Kinoblóń, who stays inside the house, and warns the father or the mother (not the husband or wife) of a sick person, in a dream, to offer dogs or pigs in sacrifice.

Upprís, who guards the foot of the ladder and prevents harmful people from entering the house.

Atugán, a sky spirit, who guards the middle of the ladder. If he happens to desert his post, the ladder breaks down.

Darińuwán, the tutelary spirit of old inhabited houses.

Baláwi, who lives outside, but protects all kinds of huts, provided they contain fire. If the inmates of a *báwi* or a *síxǎy* (two kinds of huts) allow the fire to go out, the owner gets sick.

Besides these, there are a few doubtful or downright vicious characters:

Rikoddóń, who stays in the house and occasionally awakens the sleepers by troublesome noises, whose originator, as a matter of course, can never be traced.

Lillipút, who is always moving about and travels continually from house to house.

Xamrút, who forcibly pulls (*xamrútan*) people out of their houses.

Kópaň, a blind spirit, who roams around at night, either in the bushes or in the village, and occasionally enters one of the houses: he is always intent on making other people blind like himself.

Balanéban (at Bolo) or *Balaníban* (at Bayag), who wanders among the houses, in their immediate neighborhood: his aim is to kill people.

Balawán, a female spirit, who resides in the granary; if the contents are found to be in disorder, the owners know it to be *Balawán's* doing.

When people have to stay in a hut on account of the children, they must offer *inapúxān* (betel for chewing) to one or more of the spirits who reside there, and at the same time recite one of the following prayers (texts obtained from Lampá, a Dangla man):

Iápugko ikáw siňrút ta awánmo siňrútan kadakamí.	I offer betel (for chewing) to you, Singrut, so that you do not swallow any of us.
Iápugko ikáw áňot ta dínakami aň-aňótan.	I offer betel (for chewing) to you, Angot, so that you do not smell about us.
Iápugko ikáw xumugguúd ta dínakami xu-xuudán.	I offer betel (for chewing) to you, Xumuguud, so that you do not measure us.

Although evil spirits seem to be lurking about everywhere, the Isneg are never at a loss to thwart their wicked designs. Besides prayers and offerings, they possess a copious assortment of amulets, some of which are powerful not only against the influence of ill-intentioned spirits, but also against destructive forces of nature.

The most important amulets for the protection of the house and the family, together with their practical use, are the following:

Daguwáy: a herb, some eight inches high, growing almost anywhere. It prevents evil spirits from entering the house.

Díla aníto (literally: spirit's tongue): a low sturdy plant with leaves forked at the top, probably a kind of fern.

Sanigmuyáw: a small herb with comparatively large leaves, growing all over the district.

Abisiyó-: a very small flowerless plant with needlelike leaves, growing on rocks. Any of these three, when placed next to the entrance, denies access to all kinds of evil.

Baliwâg: a herb with leaves that are whitish underneath, some eight inches tall, growing in woody thickets. An amulet against agues.

Padi-dí-: a very low herb, growing in forests. It guards the house in a village contaminated by smallpox, and it drives out the scourge if any of the inmates has been infected.

Tupláy: a very common herbaceous vine with very pubescent leaves. When placed under the hearth, it shields the house from the danger of fire.

Nagbăyúgān: a fragrant herb, some 25 inches tall, with very long leaves. When planted in the immediate neighborhood of a dwelling, it protects the latter from landslides.

Palañípāñ: a very tall fern. Its fronds drive all *kumí* (a kind of small cockroach) out of the house. I am not sure whether this plant is a mere amulet or a real insectifuge.

Saddâñ: a herb, some twelve inches tall, with comparatively long leaves. A protective amulet.

Da-dapâg: a very common small herb with diminutive leaves. When placed on the *páxa*-shelf, over the hearth (*dapâg*), it insures the protection of the *Pílăy*-spirits.

Inbapsóñ or *inbabsóñ:* a small herb growing on trees in the forest. It is placed under the eaves as a resting place for passing spirits.

A *tabăyug* (inflorescene of the bamboo grass) is placed over the door of the house, at the outside, lest the spirit *Kapónān*, the owner of all *tabăyug*, cause any of the children to become sick.

Potáran: a very common herb, some 10 inches tall. When placed in other people's houses, it allures any kind of sickness that may be coming around, and keeps it busy there.

The ubiquitous *takkág* (*Lygodium* sp.) has been alluded to several times in former papers. This fern is to be found at any place where *Pílăy*-spirits rule.

All Isneg have a thorough knowledge of the taboos or prohibitions that refer to the house and the granary, and they strictly observe them.

It is absolutely forbidden to bring *sípañ* (young meatless coconuts) into the house, especially when somebody is sick.

Cutting the rattan bands (*takád*) of the flooring is taboo, lest the children get sick.

It is prohibited to cut or notch any part of a house built by a *maíñal* (brave), under penalty of being *mabárut* (to become thinner and thinner until death ensues). Nevertheless there are two ways of avoiding this calamity:

Wrap a part of the stem of the *amárut* in a piece of cloth and tie it around the waist. The *amárut* is a herbaceous vine, with rough oblong leaves and a profusion of stems that spread from its base: it grows on high rocks.

Have a *maíñal* apply his pouch, in which are concealed some herbs with whose efficacity he is acquainted, to your nose and sniff it thoroughly.

Laughing at certain animals causes the destruction by water (*malbó*) of the mocker's (*maxinalbó*) house. There are two versions of this taboo and of the punishment meted out to those who infringe it:

According to one version, it is forbidden to joke with cats and dogs, for instance by placing them under your coat and laughing, lest a hole or a cave suddenly appear under your house and water well up from it, causing the building to tumble down (*malbó*) and all those who shared in the transgression to die.

According to another version, butterflies may not be laughed at, lest a heavy rain cause a flood, and the latter destroy the house of the culprit.

It is not allowed to keep a dog in the house, when the master is absent, lest the dog howl (*magťól* or *magtañóol*), which is taboo.

Except when in the act of extracting rice from a granary, nobody, not even the owner, is permitted to touch any of the *andíliñ* or round boards that cover the upper part of the posts, lest the person become sick.

If you stumble (*meba-dúl*) on the ladder of the house, in going down, you should not proceed, but turn back and reenter the house; after that you may try it again.

It is forbidden, under penalty of death, to pronounce the name of the man-killing *sawsáw*-bird, whenever its voice is heard in the immediate neighborhood of the house.

There are a few other ill-omened animals known to the Isneg, whose evil influence is not as easily prevented as that of the *sawsáw*, for instance:

The *talamánud*, an invisible bird, whose cry announces the irruption of some infectious disease into the town.

The *kulaxáw*, probably a kind of mole cricket, which causes the death of one of the inmates of the house under which it is heard.

The *dáñaw*, a stinkbug, which brings sickness to one of the inmates of the house it enters.

The *alipatpát*, a firefly, which kills one person for each spark that is produced when it comes into collision with fire, inside the house.

The *alipáp* or common lizard, whose cry announces the death of a member of the family. If this *alipáp* is seen moving about among the jars that contain the drinking water, it means that a visitor may soon be expected.

The following animals are of an auspicious character:

The *bagbagsíñ*, a kind of invisible insect: when its cry is heard in or around the house, and more especially near the hearth, it predicts the probable arrival of meat (of a deer or of a wild boar).

The *bi-bít*, a kind of insect: when its cry is heard behind the house, not far from the place of the hearth, it gives promise of the *balêt*-trap catching a deer or a wild boar.

The *barikóko*, a kind of large snail, whose entrance into a house has the same meaning as the cry of the *bi-bít*-insect.

If a person steps through the floor of a house, this means that his leg has been pulled down by the spirit *Dêkut*, and the result is perpetual lameness.

ILLUSTRATIONS

PLATE 1

FIG. 1. Isneg house at Abbil: Front side and annex.
2. Isneg house at Abbil: Gable.

PLATE 2

FIG. 3. The fifteen posts of an Isneg house:
a. *Síñit.*
b. *Adíxi.*
c. *Atobtóbo.*
d. Imaginary line corresponding to the walls of the house.

4. Top of a post:
a. *Síñáy* or mortise.

5. Plan of an Isneg house:
a. The house proper.
b. *Adíxi* or tall posts.
c. *Atobtóbo*-post.
d. Walls of the house.
e. *Tarákip* or annex.
f. *Tamúyoñ* or platform.
g. *Dapũg* or hearth.
h. Ladder.
i. *Kasixídān* or left end of the house.

6. End of a post:
a. *Boñráw* or edge.

7. End of a beam:
a. *Bonráw* or edge.

8. Girders and floor joists:
a. *Añadixiân* or girders.
b. *Toldóg* or floor joists.
c. *Síñit* or short posts.
d. *Adíxi* or tall posts.
e. *Atobtóbo*-post.

9. A *Toldóg* or floor joist:
a. Mortises for the *tápi*-beams.
b. Mortises for the *añadixiân* or girders.

10. *Tápi*-beam that runs lengthwise:
a. Mortises for the *tápi*-beams that run breadthwise.
b. Mortise for the *agnádan.*
c. *Adíxi* or tall posts.

11. *Tápi* and *agnádan:*
a. Floor proper.
b. *Adíxi* or tall posts.
c. *Atobtóbo*-post.

d. *Agnádan*-beams running lengthwise.
d'. First *agnádan* (resting on a *tápi*-beam).
d". Fourth *agnádan*.
e. *Tápi*-beams running lengthwise.
e'. *Tápi*-beams running breadthwise.
f. *Tarákip* or annex.
g. *Tamúyoñ* or platform.
h. *Páwat* or pegs.
i. *Kasixídān* or left end of the house.

12. Either of both ends of first *agnádan* (d' of Fig. 11).
13. Tenons of the two *agnádan* (d of Fig. 11) corresponding to the mortises shown in Fig. 12.
14. One of the two *agnádan* running lengthwise (d of Fig. 11):
    a, b, c. Correspond to a, b, c of Fig. 15.
15. Fourth *agnádan* (d" of Fig. 11):
    a, b, c, Cf. Fig. 14.
16. End of an outer *sakkár* or tiebeam that runs breadthwise:
    a. Mortise for the *axêrān* that runs lengthwise.
    b. Tenon on which rests the *axêrān* that runs lengthwise.
17. End of an *axêrān* that runs lengthwise:
    a. Tenon.
18. End of an *axêrān* that runs breadthwise:
    a. Mortise for the tenon shown in Fig. 17.
19. Queen-post: the side that faces the king-post:
    a. Where the lower *sókar* or straining piece pierces the queen-post.
20. Queen-post: One of the edges.
21. Central truss:
    a. King-post.
    b. Queen-posts.
    c. Upper *sókar* or straining piece.
    d. Central *sókar*.
    e. Lower *sókar*.
    f. Third *sakkár* or central tiebeam that runs breadthwise.
22. Outer truss:
    a. *Atobtóbo*-post.
    b. Queen-post.
    c. Upper *sókar*.
    d. Central *sókar*.
    e. Lower *sókar*.
    f. Outer *sakkár*.
23. Carved ornaments on the central *sókar* or straining piece of the central truss:
    a. Place of the king-post.
24. Cross section of an *alásip* or central purlin.
25. Ogival gable:
    a. Lower edge of b.
    b. *Axêrān* (upper beam of the wall) that runs breadthwise.

c. *Pa-gér.*
d. Lower *axérān* of the gable.
d'. Upper *axérān* of the gable.
e. *Atobtóbo*-post.
f. Tenons of the *axérān* of the house that run lengthwise.
g. Tenons of the purlins.
h. Upper *sókar* or straining piece of the outer truss. (c of Fig. 22).
i. Open space or *tabúñān.*
j. Walling of the gable.

26. Outside frame of canes in the gable over the lean-to roof of the annex.
27. Cross section of the central purlin of the lean-to roof.
28. Carved ornaments on the rounded surface of the central purlin of the lean-to roof.
29. *Talaxátag* lath of the *tamúyoñ* or raised platform.
30. Side of a *tápi*-beam next to the *tamúyoñ* or raised platform:
    a. Mortises occupied by the ends of the *talaxátag*-laths.
31. Two *baládug*-boards on either side of a post:
    a. Place of the post.
32. Small board that connects the *tamúyoñ* or raised platform with the *atobtóbo*-post:
    a. Place of the *atobtóbo*-post.
33. Cross section of the *agnádan* (lower beam of the wall) of the annex.
34. Inner surface of the *agnádan* (lower beam of the wall) of the annex.
35. Carved ornaments on the outer surface of a *baxákat* or window sill.
36. Cf. 35.
37. Carved ornaments on the outer surface of a *Pasañgír* or upright of a window frame:
    a. Parts cut out entirely.
40. Short post or *síñit* of a granary:
    a. Whereon the *alediñ* (Fig. 43) rests.
    b. Mortise for a *batáñān* that runs lengthwise.
    l. *Lappó* or *uppó.*
41. *Batáñān* that runs lengthwise:
    a. Mortises for the *batáñān* that run breadthwise.
42. *Batáñān* that runs breadthwise:
    a. Mortises for the *batáñān* that run lengthwise.
43. *Alédiñ* or *andíliñ:*
    a. Place of the mortised top of the *síñit* or short post.
44. *Adpár* or tiebeam that runs lengthwise:
    a. Mortises for the *pálut.*

PLATE 3

FIG. 38. Isneg granary at Lettuakan.
39. Isneg granary at Langnaw.

PLATE 4

FIG. 45. Two *pálut* outlining a gable:
- a. Upper tenon which rests in the mortise of the *adpâr* (a of Fig. 44).
- b. Lower tenon which supports the *adpâr*.

46. *Tambabăy*-side of a granary (front or back):
- a. *Talabáwan* or ridgepole.
- b. *Adpâr* or tiebeam.
- c. Roof.
- d. *Tambabăy* (wall).
- e. *Batáñān*.
- f. *Alédíñ* or *andíliñ*.
- g. *Síñit* or short posts.

47. *Tampaníki* or gable end of a granary:
- a. End of ridgepole.
- b. Ends of *adpâr* or tiebeams.
- c. *Tampaníki*.
- d. *Batáñān*.
- e. *Alédíñ* or *andíliñ*.
- f. *Síñit* or short posts.

48. Door of a granary:
- a. *Aga-dálān*.
- b. Upper piece of timber.
- c. *Dadamkán* or doorsill.
- d. *Adpâr* or tiebeam.
- e. *Baxákat*.

49. One of the *aga-dálān* of an Isneg granary:
- a. Hole for the wooden bar.

1

2

PLATE 1.

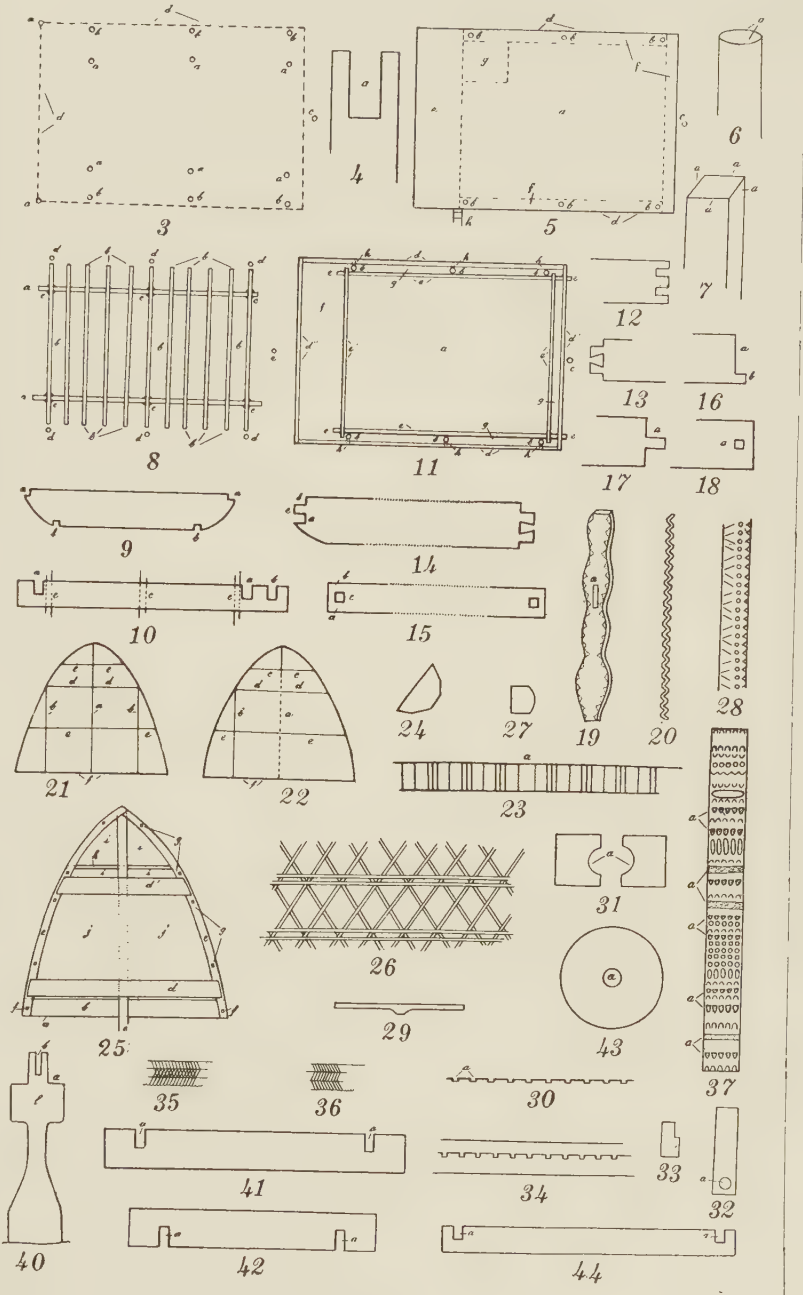

3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
40
41
42
43
44

PLATE 2.

38

39

PLATE 3.

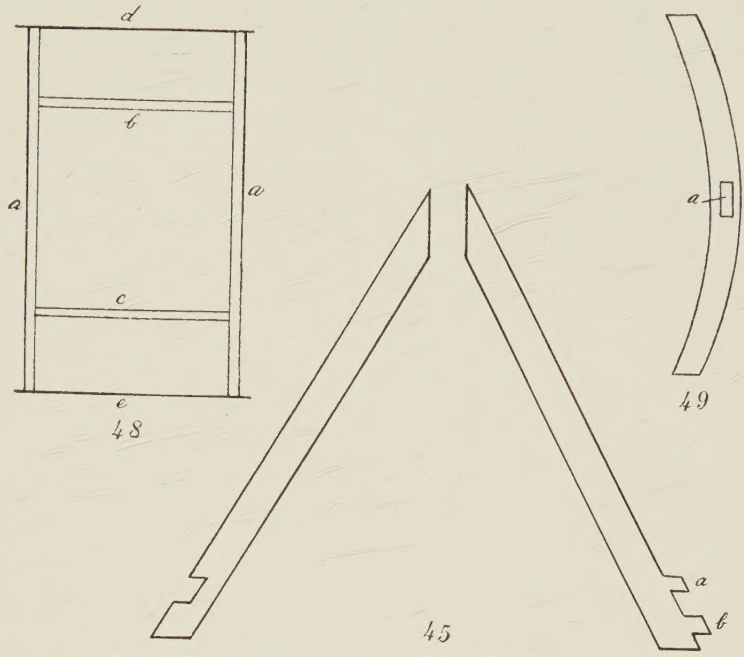


PLATE 4.

THE PHILIPPINE JOURNAL OF SCIENCE

Manuscripts intended for publication in the Philippine Journal of Science should be sent to the Editor, The Philippine Journal of Science, Institute of Science and Technology, Manila, Philippines.

Manuscripts on biology must be accompanied by abstracts for publication in the Biological Abstracts.

Fifty separates of each paper published in the Journal are furnished to the author without charge. Additional copies may be had at the author's expense if ordered when the manuscript is submitted for publication.

Publications sent in exchange for The Philippine Journal of Science should be addressed: Scientific Library, Institute of Science and Technology, Manila, Philippines.

CONTENTS

Page

TEMPLA, MAGDALENA ALDE. Preliminary studies on the utilization of copra meal for plastics 1

HERRE, ALBERT W. C. T. Eight additions to the Philippine fish fauna, including three new species 9

PAUL, ASOKA KUMAR, and ROBINDRA MOHON DATTA. On the morphology and development of the female gametophyte in *Oryza coarctata* Roxb. 15

ALEXANDER, CHARLES P. Records and descriptions of Japanese Tipulidæ (diptera), Part I. The crane-flies of Shikoku, I 21

VANOVERBERGH, MORICE. Isneg Buildings 77